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Public Health Services and Staff Requirements

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IN recent years public health administrators have been compelled to view, with increasing concern, the problem of the more effective use of available trained personnel. When we have been required to estimate the number of staff necessary to provide a given pattern of service, we have lacked a basis for making a reliable calculation. Something more readily defended than the presently used empirical formula is essential. During the past six years in Ontario, various methods of computing staff requirements have been tried. More recently we have carried out an intensive study of public health services and on the basis of this study have devised a new procedure which appears to offer what we think are demonstrable advantages.

It has been usual practice to estimate staff requirements in terms of thousands of population to be served. We are all familiar with the formula of one nurse per 5,000 population, one sanitary inspector per 15,000 population and so forth. It is obvious, however, that the provision of a given program to a population with urban distribution should not require the same complement of staff as would be required if the same population had a rural distribution. Accordingly, we have for some years recognized the fact that population dispersion creates a handicap which can only be overcome by a supplement of staff time to meet the demand of additional travel. A rather simple method was adopted to calculate a staff equivalent for this handicap.

A population-roadmile ratio of 100 to 1, or greater, was considered to present a degree of dispersion which did not create a significant travel handicap. As the population dispersion increased, a handicap was considered to exist and this handicap could be expressed in terms of staff time. Essentially, the method we have used calculates the population which would have to be added to a

program area to bring the population-roadmile ratio up to 100 to 1. This additional population, together with the actual population, was then used to estimate staff needs. This method assured that rural areas could be given a service which compared more favourably with that provided in urban centres.

We early discovered that our previous assumption that the need for service varied directly with the size of population was not too well founded. In fact, there is little evidence to justify this assumption and some evidence to the contrary. Actually, population per se is not the determining factor in calculating staff needs, in that the majority of population actually receive little direct service. Service is given mainly to the concerned minority, with the majority benefitting indirectly. It appears, therefore, that although population size exerts an over-all influence on staff needs, it is the extent and variety of the public health problem or problems which determines the pattern of program activity and thus dictates the staff requirements.

Observations have indicated that the extent of public health problem varies in different areas, even when these areas are in close proximity. The problems of urban and rural communities are obviously different, not only in nature but also in extent. It appears that while two areas, adjacent or otherwise, could have similar public health problems, they would not be identical. For example, we are not justified in assuming that the birth rate or age composition of the population is uniform throughout the jurisdiction which comes under our administration. We know, in fact, that such uniformity does not exist. Further, infections such as tuberculosis and venereal diseases are not uniformly seeded throughout the population. Neither do the problems of environmental sanitation or those of food control occur with equal frequency.

Knowing these facts and realizing that, in the interests of efficiency and economy, available staff time should be allocated according to need, it was essential that we devise some simple and yet acceptable method of measuring the magnitude of our problem. A wide range of statistical data was available to us but these data varied as to reliability. Our objective was to find a single statistic related to each field of activity which, among the available and reliable statistics, could be said to be the 'critical statistic' for the field.

The critical statistic for a given field of activity was defined as a unit of the population which was significantly concerned in the activities of staff in that special field. Such a statistic we believe would be expressive of the potential demand for service in that field and thus would be expressive of the extent of the existing problem.

Analysis of the detailed data, collected in our study, indicated that public health service could be divided into eleven fields of activity. These are as follows:

- Tuberculosis Control
- Venereal Disease Control
- Communicable Disease Control
- Maternal and Infant Health
- Child Health
- Elementary School Health
- Secondary School Health
- Rural Sanitation
- Urban Sanitation
- Miscellaneous Health Services
- and
- Administration

The following critical statistics were selected, one for each of these eleven fields of activity. It should be noted that in two instances the same statistic was chosen for more than one field. It should be further noted that every critical statistic is a function of the total population, that is to say, each unit of critical statistic represents a member of the community.

The critical statistic selected for the field of Tuberculosis Control was—a new active case of tuberculosis, for

Venereal Disease Control—a contact investigated
Communicable Disease Control—an elementary school child
Maternal and Infant Health—a resident live birth
Child Health—a child beginning school
Elementary School Health—an elementary school child
Secondary School Health—a secondary school child
Rural Sanitation—a unit of rural population
Urban Sanitation—a unit of urban population
Miscellaneous Health Services—a unit of total population
Administration—a unit of total population

We were now in possession of a method of measuring population dispersion and a method of measuring the extent of public health problem. We then undertook an intensive study of public health services, as they were provided during the year 1953 with the objective of finding a method of calculating staff requirements, based upon extent of public health problem, rather than size of population.

A statistically acceptable sample of public health programs, fifteen in all, under full-time medical officer of health administration, was studied and detailed data respecting staff activities were collected, compiled and analyzed. Four services were under review, namely: medical, nursing, sanitary inspection and clerical. Other services were not included except insofar as the staff concerned substituted for one of the four services under study. For example, public health veterinarian service was not included, except insofar as the veterinarian substituted for the sanitary inspector.

The programs studied varied from completely urban to highly rural areas and the population size ranged from over 200,000 down to 15,000. The factual data collected gave a complete picture of the activities of the four services in terms of standardized half days of time, with five hundred half days representing one full time unit of service. The activities and the related time were compiled, for each service by field. In this way the number of half days of service provided by each of the four services, in the eleven fields, was determined for the fifteen public health programs reviewed.

It now remained for us to determine a formula method by which, using critical statistic values, we could calculate staff requirement for each of the four services. Since such formulae would be based upon data collected in the study they would naturally calculate the staff required to give service as it was provided during the year 1953. Moreover, these formulae could then be used to calculate the staff required to give a similar extent of service in any area in the Province, with respect to which critical statistic values were available. If the extent of service were to be increased or decreased, the staff requirement as calculated by formula would have to be adjusted accordingly.

We were unable to find any simple or ordinary mathematical method of determining the required formulae. We discovered, however, that a method

had been used successfully in solving similar problems in the fields of industry and agriculture. This method is known as Regression Analysis. Regression analysis relates to the problem of estimating the value of some dependent variate Y on the basis of information respecting one or more independent variates x_1, x_2, x_3, \dots . The basic meaning of "regression", i.e. "going back" does not help us to understand its technical meaning. It receives its name from the fact that in the biological field, it has been noted that the forces of heredity do not lead offspring to inherit in full amount the peculiarities of the parents. If both parents are one inch taller than the normal, the chances are that their children will be something less than one inch above the average stature. In other words, they regress towards the type, hence the term regression.

Regression analysis has been used to estimate the yield of wheat in bushels per acre, on the basis of the amount of nitrogen, phosphate and potash applied to the soil. Alternatively, wheat crops have been forecast on the basis of the aggregate number of inches of rainfall, the number of days of sunshine, and average temperature, during the months of April and May. While our problem was not demonstrably related to those of agriculture, in that we wished to estimate staff requirements based upon the extent of public health problem as expressed by related critical statistic values, we were encouraged to use this instrument of assessment.

A number of regression analyses were performed which related to each of the four services. The result appeared to be more than satisfactory. You will appreciate that the mathematical computations involved are far too complex and extensive to discuss in a paper which at best is merely a progress report. However, full details of these calculations have been recorded in a monograph covering the study. It is sufficient to say, at the present time, that the application of the methods of regression analysis, to the data pertaining to the fifteen public health programs included in the study, resulted in statistically acceptable regression equations for each of the four services under study, namely: public health nursing, medical, sanitary inspection and clerical.

The regression equations, or formulae, are surprisingly simple since they just consist of coefficients and critical statistic values. Only four critical statistic values, in total, are required for substitution in these equations. These critical statistic values are,

1. number of elementary school children
2. number of total population
3. number of resident live births
4. number of new active cases of tuberculosis

For example, to calculate public health nursing time only three critical statistic values are required, the number of elementary school children, the number of total population and the number of resident live births. By substituting these critical statistic values in the public health nursing formula, the answer, in terms of half days of public health nursing time, can be calculated. Three critical statistics are used in the medical formula, namely; elementary school children, total population, and new active cases of tuberculosis. The sanitary inspection and clerical formulae require but one critical statistic value, namely; total population.

It thus appears that we have accomplished our objective and now have a formula method of determining staff needs based upon the extent of the public health problem.

Our study has thus served the purpose of devising formulae, which are suitable for the calculation of staff requirement, with respect to each of the four services under study. However, our study related to public health activities, as they were carried out in 1953 in the Province of Ontario, and we are fully aware of the fact that the service as rendered in Ontario in 1953 was not necessarily an ideal pattern of service.

There is still need, therefore, to investigate the effectiveness of the public health service in this Province with a view towards determining the minimum pattern of activity which would be considered to be adequate to cope with existing public health problems. There is no doubt that the determination of this minimum pattern of activity will result in a modification of the present distribution of available public health staff time. However, the re-allocation of staff time, among the various fields of activity, need not result in a demand for additional staff time since there is evidence that too much time is presently being spent in some activities, at the expense of other equally important phases of the program.

Trained, and skilled, public health personnel are at a premium and we have no reason to believe that shortages which now exist will not continue to exist, at least for some time to come. Everything possible, therefore, should be done to more effectively use the available time of staff. We are hopeful that the studies we have carried out, and those which we are presently pursuing, will result in an improvement in the more effective use of present staff. There is also a reasonable expectation that with a method of evaluation of proven value we can improve our position when we seek the support of the employing agency. The result should be to assure for public health a more generous share of tax collected funds.

This study, which has been based on data respecting local public health practice in the Province of Ontario during the year 1953, has made possible a method of calculating the staff time required, by any local health agency, as dictated by their peculiar public health problems, for each of the following four services—nursing, medical, sanitary inspection and clerical. A supplement of staff time can also be ascertained to compensate for the fact that population dispersion creates a handicap which can only be overcome by an addition of staff time to meet the demand of additional travel, thus assuring for rural areas a service more comparable with that provided in urban centres.

This study is but the beginning of a pattern of studies which we are presently pursuing with but a single objective in mind, namely; to improve the efficiency and the effectiveness of the services we are providing and in this way strengthen the foundation of our expanding structure of public health.

Some Problems in the Epidemiology of Neurotropic Virus Infections

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NEUROTROPIC virus diseases in the human host have assumed greater importance during the past decade. What appears to be an increased incidence may be a valid observation of what is happening, or it may be due to an increased awareness combined with improved methods for diagnosis. In some instances neurotropic variants of viruses specific for other organ systems may be playing a more important role.

The fact that the clinical manifestations of these diseases are extremely variable while, at the same time, showing common characteristics presents a difficult problem to the practising physician and health officer alike. Infection of the central nervous system by mumps, influenza, coxsackie or herpes simplex viruses will frequently result in some symptoms or signs common to infection with LCM virus or certain rickettsial organisms.

While it may be possible to differentiate between frank cases, it is almost impossible when abortive, systemic or inapparent infection is present. It is in these situations that the attending physicians and the health officer in teamwork with expert aid can often cast the necessary light by determining the particular epidemiological and serological pattern of the virus involved.

These observations are of special significance in regard to the simultaneous occurrence of poliomyelitis and WEE in the prairie provinces. In recent years Saskatchewan has experienced endemic levels of poliomyelitis climaxed by the two serious epidemics of 1952 and 1953. During most of these years other neurotropic virus infections, particularly WEE, have appeared during the same season. Because of the prior attention given by physicians and the public to poliomyelitis, because of the dramatic severity of the paralytic form of this disease, and because technical resources tended to be geared for the diagnosis and care of this condition, many cases infected with other neurotropic viruses were unrecognized.

In the concurrent outbreaks of poliomyelitis and WEE in Manitoba in 1941, Adamson and Dubo reported the essential clinical differences between the two diseases (1). However, without a careful, many-sided inquiry into the

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epidemiological characteristics with supporting serological and, if possible, virological confirmation, mild and abortive cases of WEE will be reported as poliomyelitis.

Despite a reduced confidence in the relative reporting of poliomyelitis and encephalitis, an appreciation of some of the main points in their epidemiology is essential; and this knowledge must certainly be advanced if we are to find those measures which will effectively control WEE in humans.

Poliomyelitis was first reported in Saskatchewan in 1910 and until the mid-thirties rates fluctuated between about 2 and 4 per 100,000. Thereafter four sharp outbreaks occurred in 1937, 1947, 1952 and 1953 (Table I). The last

TABLE I
REPORTED INCIDENCE OF POLIOMYELITIS AND ENCEPHALITIS:
SASKATCHEWAN, 1922-1953

	Poliomyelitis		Encephalitis	
	Number	Rate per 100,000	Number	Rate per 100,000
1922-26	77	2.0	-	-
1927-31	169	3.8	-	-
1932-36	160	3.4	5	0.1
1937	512	55.5	1	0.1
1938	30	3.3	44*	4.8
1939	16	1.8	4	0.4
1940	9	1.0	-	-
1941	56	6.2	543	60.6
1942-46	126	3.0	35	0.8
1947	275	32.9	68	8.1
1948	90	10.7	12	1.4
1949	112	13.5	15	1.8
1950	115	13.8	12	1.4
1951	91	10.9	17	2.0
1952	1,223	145.1	13	1.5
1953	1,187	137.8	12	1.4
1954	196	22.3	18	2.1

*Only 3 of the 44 known cases were officially reported.

two epidemics were the most severe in the province's history leaving many hundreds with resultant disability.

WEE reported as "epidemic encephalitis" was unknown or unrecognized prior to 1933. In that year four cases were officially reported but one cannot be certain that the diagnoses were correct. Fulton first described the initial outbreaks of equine disease in 1935 (2) and subsequent epizootics in 1937 and 1938 (3). He refers to reports from physicians of human cases in 1935 but not until 1938 was he able to demonstrate neutralizing antibodies in the sera of a few cases. Gareau described a series of 1938 cases (4) which had been initially mistaken for "flu" and poliomyelitis.

While only one case of encephalitis was officially reported in 1937, the first sharp outbreak of poliomyelitis occurred in that year leading to a total of 512 cases or a rate of 55.5 per 100,000. The official report (5) describes the presence of such symptoms as tremor, drowsiness, mental confusion, photophobia and diplopia among many cases. It is entirely reasonable to assume

that these symptoms occurred in persons with acute encephalitis rather than poliomyelitis.

The first major epidemic of encephalitis emerged in 1941 coinciding with similar outbreaks in Manitoba, North Dakota and Minnesota. A total of 543 cases were reported, or a rate of 60.6 per 100,000, which was ten times greater than the incidence of poliomyelitis in the same year.

The year 1947 saw a peak in poliomyelitis incidence of 32.9 per 100,000 accompanied by an above-average rate of 8.1 for encephalitis. Finally when poliomyelitis rose to epidemic proportions in 1952 and 1953, encephalitis remained relatively stationary at 1.2 to 2.0 cases per 100,000.

Seasonal Patterns

The seasonal parallelism of the two diseases is well-known. In the major poliomyelitis outbreaks the peaks were reached during late August. In the 1941 encephalitis epidemic the peak was reached in the third week of August.

At the same time the epidemic curves of these two infections are clearly distinct. Poliomyelitis outbreaks start earlier, rise as rapidly, but decline much more slowly than WEE. In the three epidemic years of 1947, 1952 and 1953, only 35 to 45% of cases occurred in August whereas 84% of all cases in the 1941 encephalitis outbreak had their onset in that month. This important difference in seasonal patterns is wholly explainable by the personal contact transmission of poliomyelitis as against the mosquito transmission of WEE.

Rempel in his comprehensive review of the mosquito population in Saskatchewan (6) produces convincing arguments to substantiate the transmission of WEE virus by mosquitoes, particularly *Culex tarsalis* and *Culiseta inornata*. The role of hot summer seasons accompanied by more or less regular and abundant rainfall and its influence on mosquito breeding and presumably increased infectivity rates is stressed.

Endemic Foci in Saskatchewan

Poliomyelitis in non-epidemic years has had a fairly wide distribution throughout the province. Even in the 1952 and 1953 epidemics when greater concentrations of cases were seen in the Saskatchewan and Regina areas, the disease was prevalent in most areas.

While sporadic cases of WEE have been observed in scattered areas, distinct concentrations have occurred in four areas in the southeast portion of the province ever since cases were first recognized. The areas include the Regina district (including Regina city), the Moose Jaw District (including Moose Jaw city), the Weyburn-Midale-Radville district, and the Yorkton-Melville district.

While the preponderance of cases in these four endemic foci was most marked in the 1941 epidemic, small groups of cases have repeatedly emerged in these districts during years of reduced incidence.

1953 Outbreak in Radville Endemic Area

In the midst of the 1953 poliomyelitis epidemic, it was possible to observe a small concurrent outbreak of poliomyelitis and WEE in the Radville endemic area.

One of us (R.J.P.B.) diagnosed the first case of paralytic poliomyelitis during the first week of August. In the second week two additional cases of paralytic disease appeared. These were followed by what seemed to be additional cases of non-paralytic poliomyelitis continuing into the first week of September.

Commencing the second week of September, over a period of eight days, eleven children in a convent boarding school in Radville became ill with varying meningo-encephalitic symptoms. At the same time the first adult cases which aroused suspicion of the presence of an encephalitic syndrome occurred and they were hospitalized for more intensive study. Meanwhile the boarding school was closed and the children sent home.

Over the entire period of this circumscribed outbreak from August 10 to September 27 a total of 53 cases was discovered. Of these seven were clinically poliomyelitis, 36 were clinically WEE, and 10 convent schoolchildren were doubtful as to diagnosis. Of the 10 schoolchildren with initially doubtful diagnoses, one was subsequently confirmed serologically and two presented WEE neutralizing antibodies of a low titre in their sera.

For the entire series of cases, no deaths occurred and sixteen months later no important sequelae were detected among the WEE patients, even though many of them had been seriously ill during the acute phase.

Serological Findings

Difficulties with the clinical diagnosis of WEE, particularly when poliomyelitis cases are occurring at the same time, underlines the importance of seeking laboratory confirmation. Virus isolation, as demonstrated during the

work performed in the 1952 encephalitis outbreak in California (7) is not likely to be of any practical value. Consequently a search for neutralizing (N) or complement-fixing (CF) antibodies is the diagnostic tool that must be employed.

Initially among the cases in the Radville outbreak, sera were examined for N-antibodies by the chick embryo method.* Subsequently it was decided to search for CF-antibodies when facilities for this work were made available.** It was only possible to arrange for the examination of sera for CF-antibodies eight months after the onset of illness and again eight months later. In addition, sera from household contacts of a majority of known or suspected cases were examined for CF-antibodies. The positive findings are shown in Table II.

One or both serological tests were carried out in 38 of the 46 clinically confirmed or doubtful cases. The results of these tests indicate that seventeen of these cases had experienced a recent infection with WEE virus.

It was regrettable that it proved impossible to conduct a search for CF-antibodies simultaneously with the examination of N-antibodies. When the serum specimens were tested for CF-antibodies eight months after the onset of the outbreak, one might have expected a substantial decline in titre. As

*These tests were carried out at the Virus Laboratory, University of Saskatchewan, Saskatoon; and the Rocky Mountain Laboratory, Hamilton, Montana.

**At Virus Laboratories, Laboratory of Hygiene, Ottawa; and Provincial Laboratories, Regina.

TABLE II
ANTIBODY RESPONSE IN CONFIRMED CASES OF WESTERN EQUINE
ENCEPHALITIS: RADVILLE OUTBREAK, 1953

Case	Age	N-antibodies* (Sept., 1953)	CF-antibodies**	
			(May, 1954)	(Jan., 1955)
L.F.	42	++++	>64	>64
D.G.	28	++++	neg.	neg.
J.Y.	27	++	neg.	neg.
O.W.	30	++	2	neg.
L.L.	5	++++	16	4
L.C.	49	++++	4	neg.
E.C.	11	not done	4	2
E.M.	9	++++	neg.	neg.
Y.L.	24	+	neg.	neg.
A.B.	NS	+++	4	4
G.B.	13	+++++	>64	8
B.K.	19	++	8	2
M.F.	24	++	neg.	neg.
M.S.	NS	++	neg.	neg.
W.K.	19	neg.	8	neg.
M.B.	5	not done	16	4
R.B.	NS	not done	8	4
<i>Contacts without apparent infection:</i>				
M.K.	NS	not done	8	not done
Mrs. B.	NS	not done	8	not done

*++++ = very high; +++ = high; ++ = moderate; + = slight.

**Titres in reciprocal dilutions.

noted in Table II, in 13 instances where N-antibodies were initially positive, seven showed positive CF-antibodies eight months later, and five of these demonstrated a persistence of antibodies at a lower titre after 16 months had elapsed. This result corresponds to the findings of other workers. Hammon (8) has stated that N-antibodies may persist for at least two years while CF-antibodies, in the majority of cases, are not found after 12 to 14 months.

It is of interest to note that in two cases CF-antibodies in very high titres were present eight months after onset and in one of these, this high titre was demonstrable after 16 months.

Multiple Cases

Multiple household cases of poliomyelitis is a frequent observation and was not uncommon in the 1953 epidemic. In fact the first two cases in this series were siblings in the same household who developed paralytic disease.

On the other hand WEE is typically distributed in a random and isolated fashion and multiple cases in the same dwelling are uncommon. In the extensive Manitoba outbreak of 1941 multiple household cases were not discovered (9). Of this Radville series multiple cases with serological confirmation were observed in four instances. In one of these households, two patients were discovered and subsequently a household contact without symptoms showed a positive serological response. In a fifth household one clinical, serologically proven case was found along with one asymptomatic contact with positive serological findings.

Serological Survey of Other Endemic Areas

Because the Radville outbreak presented a situation of mixed poliomyelitis and WEE infection, it was considered that other areas might have experienced a similar dual infection. This possibility was supported by occasional clinical reports of encephalitis-like illness during the 1953 epidemic. Consequently it was decided to undertake a serological survey in the cities of Moose Jaw and Regina. It will be recalled that these cities represented endemic foci for WEE in previous years.

The plan for this survey involved the collection of sera from all of the 1953 reported cases of poliomyelitis (paralytic and non-paralytic) that could be reached. At the same time sera were obtained from household contacts of one group of cases (Regina) and from neighbourhood controls in the other group (Moose Jaw). Initially it was intended to examine the sera for neutralizing antibodies against all three types of poliomyelitis virus as well as WEE virus. Difficulties were encountered in arranging for the poliomyelitis serological studies and when it finally became possible to undertake this work with HeLa cell tissue cultures* it was found that the large Keidel tubes used for blood collection had added substances to the sera which were toxic for HeLa cells. As a result the studies were of necessity confined to a search for CF-antibodies against WEE virus. The findings of this survey are summarized in Table III.

TABLE III
ANTIBODY RESPONSE AGAINST WEE IN POLIOMYELITIS CASES AND
CONTACTS: CITIES OF REGINA AND MOOSE JAW, 1953

	Number of poliomyelitis cases examined	Positive CF-antibodies**	
		Number of cases	Per cent
Regina	85	9	10.6
Moose Jaw	61	6	9.8
Total	146	15	10.3
	Number of contacts* examined	Positive CF-antibodies	
		Number of cases	Per cent
Regina	85	4	4.7
Moose Jaw	61	5	8.2
Total	146	9	6.2

*In Regina, contacts were in same household; in Moose Jaw they comprised neighbourhood controls.

**Serum titres of 1:8 and higher.

The combined result of these two surveys show that 10.3% of patients with reported non-paralytic poliomyelitis showed CF-antibodies eight months after onset of the disease, and 6.2% of contacts or neighbourhood controls showed the same serological response at the time of the survey.

These findings provide presumptive evidence that infection with WEE virus occurred in these two endemic foci during the 1953 poliomyelitis epidemic

*At the Provincial Laboratories, Department of Public Health, Regina; Dr. H. E. Robertson, Director.

similar to what had taken place in Radville. It is entirely possible that the proportion of WEE cases may very well have been higher since CF-antibodies likely had begun to decline eight months after the illness occurred. Further evidence that WEE was present is offered by the positive neutralization tests on additional cases from these two areas in 1953 which were performed at the Virus Laboratory at Saskatoon.

Serological Studies in 1954

The year 1954 saw a return to a relatively low reported rate of poliomyelitis (22.3 per 100,000). The experience of former years was repeated; physicians continued to observe patients with a varying symptomatology pointing to some concurrent type of infection of the central nervous system. Some cases showed the classical picture of encephalitis while many others presented a vague syndrome with only moderate or mild neurological disturbance.

Physicians were encouraged to submit sera even where suspicion of CNS infection was slight. While the response was not great a total of 171 serum specimens were finally sent in and studied. The findings are shown in Table IV.

TABLE IV
ANTIBODY RESPONSE AMONG SERIES OF CASES WITH
SUSPECTED CNS VIRAL INFECTIONS:
SASKATCHEWAN 1954

Total sera specimens tested	171
Antibodies present:*	
Western equine encephalitis	10
Eastern equine encephalitis	-
St. Louis encephalitis	1
Lymphocytic choriomeningitis	29
Influenza A-prime	7
Influenza B	16
Mumps (viral antigen)	34
Mumps (soluble antigen)	5

*Serum titres of 1:8 and higher.

In the absence of case histories and supporting epidemiological data one cannot satisfactorily interpret the positive results from a diagnostic standpoint. Nevertheless the discovery of CF-antibodies against various neurotropic viruses is some indication of the prevalent infections. The important observation to note in Table IV is the positive findings of antibodies against the viruses of WEE, lymphocytic choriomeningitis and mumps (soluble antigen).

DISCUSSION AND CONCLUSIONS

Over the past two decades, while Saskatchewan was experiencing endemic poliomyelitis with periodic epidemic peaks, the concurrent appearance of western equine encephalitis became increasingly evident. Because poliomyelitis, especially in years of high incidence, is uppermost in the consciousness of both practising physicians and the general public, an infection with WEE was usually not considered and consequently missed. The discrete dual outbreak in Radville in 1953 and the findings of antibodies against WEE

among patients reported as poliomyelitis in Regina and Moose Jaw were recent reminders that the problem of mixed infection is still with us.

That other neurotropic viruses, particularly mumps and lymphocytic choriomeningitis, can produce a mild to severe encephalitic syndrome was demonstrated from the serological survey of random cases in 1954. The importance of the neurotropic tendency of mumps virus was demonstrated by a fairly severe outbreak in southwest Saskatchewan in 1952. As reported by Bowers and Weatherhead (10) no less than 15% of all mumps cases in this outbreak developed meningoencephalitis.

While serological evidence of the presence of human cases of WEE has been demonstrated over a number of years, the existence of lymphocytic choriomeningitis has not been previously reported. Moreover, St. Louis and eastern equine encephalitis are unknown in Saskatchewan, although one contact with a low antibody titre against the former was found in the 1954 series of cases.

A review of the epidemiological data on WEE infection over past years has revealed the existence of at least four endemic foci in the southeast part of the province. The reappearance of groups of cases in areas such as Radville raises the question as to whether there are special biological and environmental factors that favour transmission.

The first three recognized major epizootics of equine disease took place in 1935, 1937 and 1938. According to Fulton (3) the first two of these began in the southeastern portion of the province, having been introduced from infected areas in the midwestern United States. As recently as 1953-54 most of the 76 reported cases of equine disease occurred in the southeast. Approximately 20 of these sick horses were recognized in the Radville area in advance of the 1953 outbreak.

From the many studies of this disease in recent years, evidence is convincing that the horse does not play a primary role in the transmission of virus to human cases. On the other hand arthropods, especially certain species of mosquitoes, have been shown to act as the major vector. Following the 1941 outbreak, Rempel (11) carried out extensive studies on the ecology of mosquitoes and found *Culex tarsalis* in very abundant numbers in the south and southeast. This is one of the few mosquito species which hibernates as an adult female. In late spring, the adults leave the sheltered areas, where they spend the winter, and venture out to seek a blood meal. The preferred host is the domestic chicken but the species will readily attack other animals, including man. *C. tarsalis* has been shown experimentally to transmit virus and to harbour the agent under natural conditions. Moreover, it is one of the few species that readily invades homes.

While it proved too late to conduct any entomological studies of the mosquito fauna in the 1953 Radville outbreak, it was clear that the temperature and rainfall conditions were suitable for a mosquito build-up. Residents in the area did, in fact, report the presence of large numbers of mosquitoes. The same climatic conditions along with a large mosquito population were also encountered in Moose Jaw and Regina.

What of the future? While we may have some assurance that vaccination

will assist in reducing the incidence of poliomyelitis, there is no reason to assume that WEE will not reappear in the endemic foci. None of the control measures that have been used to date in other areas has been more than palliative in character (12). It is of considerable importance to gain more detailed knowledge of the epidemiological characteristics of WEE as well as other concomitant virus infections. To obtain these data teamwork between the practising physician, the health officer, the entomologist and the virologist is essential. Health authorities in the western provinces can no longer delay the launching of a more concerted and planned study of this problem as the first essential step towards introducing effective measures for prevention.

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THE CANADIAN PUBLIC HEALTH ASSOCIATION

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Unmet Needs in Health Care in Canada

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IT may be that some members will expect that a paper on the above subject for a medical-care conference should be limited to a discussion of physicians and their practices among the people, or my comments should be confined to prepayment medical and hospital care plans. These are only part of the story of the unmet needs encountered in providing health care in Canada.

We, in a medical care conference, should be concerned with bringing a high standard of health care to those who are ill, or those who may become ill, in a manner which will allow the optimum prevention and treatment of illness. I have, therefore, gone farther afield in dealing with unmet needs in medical or health care, for the terms are largely synonymous, to emphasize, in selected areas, where much remains to be done to enlarge our concerted efforts to meet the health needs of Canadians.

Perhaps there are some who would hold that during the present period of the post-war boom, with our high standards of living and of medical, hospital and public health practices, the Canadian people have no unmet medical-care needs and, if they do exist, they are not worth emphasizing at this time. Let us examine the record.

One of the most troublesome difficulties for any country attempting to improve the health of its people is that of having everyone make full use of the facilities for good health that are made available to them. Ignorance, prejudice and deeply ingrained local customs and habits may prove frustrating obstacles in many fields of health endeavour. Medical officers of health will confirm that these obstacles to meeting unmet needs for health have not entirely disappeared from local communities in Canada. The answer is sustained practical health education with adequate numbers of well-trained workers and the passage of time.

Canada with a population of approximately 15,200,000 in 1954, at which time the male population exceeded the female by about 200,000, had an annual mortality rate of 8.6 persons per 1,000 or 127,381 deaths. In time, death comes to all of us. However, of this number, 72,422 died before the age of seventy and may be regarded as untimely deaths, indicating unmet needs in health care for our people.

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The average Canadian is disabled once a year, and then, is sick again but manages to keep on with his usual activities. Females have more days of illness than males but fewer disabling days and have a greater life expectancy. The average Canadian is ill during his lifetime for 3,809 days, according to the Sickness Survey, during which time he is kept from work or his usual activity for 856 days. There is indication that as the longer life expectancy is added for our people, the individual will suffer correspondingly more illness. For a population such as we have in Canada, with increasing numbers of older people, this conclusion is extremely important in preparing to meet the health needs of the future.

I will not give a detailed list of the causes of death in Canada or an ill-supported list of the causes of all morbidity. However, I would like to emphasize that the analysis of our problems becomes complex. It is not just a question of mortality or of morbidity alone. Recognition must also be made of the degree of discomfort, the inability to perform useful tasks, the length of absence from work and the effect of ill health on the future of an individual and his business.

There is a real need for research in the field, for constant observation and analysis, which over a period of years should provide a comprehensive picture of the comparative importance of unmet health needs as well as pointing the way for suitable control.

An unmet need of great and pressing magnitude is that of coping with the expanding problem of mental health care. It is alarming to find that the need for special accommodation for mental diseases in Canada may now exceed the requirements for acute hospital care facilities in our public general hospitals.

In this field shortages are manifest in every respect. Provincial Mental Health Divisions should be augmented if they are to provide adequate leadership and develop suitable province wide programs for mental care. There is some indication that acute psychiatric services should be provided in general hospitals and that local community health centres for the early detection and, hopefully, the prevention of mental illness may not only lessen the burden on custodial-care mental institutions but also permit early discharge of the patients in their care. An expansion of day treatment programs, whereby patients can live in home environments is desirable and is based on adequate community participation in local mental health programs. Mentally retarded, senile patients, and epileptics must be separated as soon as possible from those who are psychotics.

The cost of maintaining mental institutions in Canada is estimated at \$57,000,000 annually to care for a mental hospital population of approximately 60,000 people. These calculations will increase as Canada's population continues to enlarge and age, and as the public becomes more aware of what can be done to prevent and treat mental illness. Adequate building programs incorporating the newer ideas of small units rather than overlarge barrack like custodial institutions, and training programs for existing and new staffs, are of paramount importance in meeting the unmet mental health care needs in all Provinces. Nine provinces have reported staff shortages of psychia-

trists, psychologists, medical social workers, occupational therapists and nurses for both administration and teaching.

Research in mental diseases should be continued and expanded as a top priority in institutions, general hospital clinics and community centres, in the hope of finding early leads which can reduce the problem of mental ill health to the point of control.

Although the total national effort of all concerned in working towards the eventual control of cancer is great in terms of millions of dollars spent, research under way and surgical, medical and radiological services provided, the unmet need in cancer remains with us in that we must still find the true causes of cancer and, thereafter, evolve adequate treatment and control. Our most reliable weapons in this regard consist of ever widening research and experimentation, and bringing to the people and their physicians the latest information and equipment for diagnosis and treatment at an early stage when there is a hope of cure. Almost 20,000 cancer deaths occur annually, many of which occur because diagnosis and treatment do not now reach the patient in time.

Of increasing importance to Canada, with increasing numbers of older people, are the unmet needs in chronic care. One is gratified to note the passing of the old term 'Home for Incurables'. Workable definitions are an unmet need. Although everyone is able to identify in his own mind what is meant by chronic care and chronic patients, it is difficult indeed to exactly define the terms. With the passing years, degenerative processes begin and in broad terms most of us are sooner or later chronically ill. Moreover, chronic illness is usually for each person a complexity of several illnesses or conditions, each of which may require treatment with the hope of alleviation but which rarely results in restoration of complete function in every way.

I will refer elsewhere to the unmet needs for beds in chronic care hospitals. I would emphasize here that again the problem is complex. There are those who are chronically ill but require acute treatment, perhaps, in acute general hospitals. Others require a mixture of custodial care and more or less continuous treatment for months or years in the hope of salvage or merely to provide reasonable comfort. There are others, also, who will require custodial and supervisory care for prolonged periods of time, perhaps for the rest of the patient's life. Even here, medical supervision and care will be required. Finally, for a few, the incurable stage may be reached where little beyond custodial institutional care is required.

Complex problems require complex approaches for control. Restoration of as many of our chronically ill patients to community life with as complete restoration of function as possible is a must, for economic and humanitarian reasons and because it may be impossible to institutionalize everyone who is chronically ill. This is a most challenging field, where prevention properly envisioned and applied may yield untold dividends in the maintenance of the economic independence of the individual, the prevention of disability and of untimely death.

Briefly, I would indicate that approximately 800,000 adults may be suffering from diseases and defects of the heart and arteries in Canada, while about

180,000 are disabled; that over 600,000 suffer the ill effects of arthritis and rheumatism—while 225,000 are disabled; that approximately 175,000 may suffer in varying degrees from diabetes, about 70,000 from epilepsy and 25,000 from multiple sclerosis. There are many other conditions afflicting many people to a chronic degree. Handicapping conditions in children, left unattended, constitute in due course a large problem of unmet illness for chronic care.

The economic and humanitarian values of Medical Rehabilitation Programs have become increasingly recognized within the last few years. It can be said of Canada that we are undergoing a tuning up or preparatory stage in this field. All provinces have not completed or announced province-wide programs for medical rehabilitation. All are watching carefully and analyzing the first year's experience in the operation of the Disability Pension program to determine what the associated annual load of adult rehabilitation may be.

During the present year the Medical Rehabilitation grant is being utilized not only to assist Provinces in establishing necessary rehabilitation centres and training the personnel for staff but is also being carefully used to allow assistance with the rehabilitation of individuals who would otherwise be eligible for a pension. There is accumulating pressure to also use the grant to assist with the purchase of service for the rehabilitation of those who, having presented themselves for an examination for pension are found not to be eligible but are in need of rehabilitation. The fact that such individuals have often travelled a long distance to a city centre, and have had a detailed history and examination completed, argue for a suitable extension of rehabilitation services on their behalf. No doubt, province wide organization will be developed in due course to provide co-ordinated and efficient rehabilitation services for all who are in need of them.

Additional rehabilitation centres will be required in strategically located centres, often in connection with the larger, well organized hospitals and where possible under the supervision and influence of university medical schools.

The development of enlarged Medical Rehabilitation programs has pointed up a great shortage of workers in this field. Large numbers of competent physiotherapists, occupational therapists, speech therapists, gymnasts, bracemakers, medical social workers and the appropriate medical specialists in physical medicine and allied fields will be required. Although teaching centres have developed at Montreal, Toronto and Edmonton, it is unlikely that they can keep abreast of the accumulating demands. Nor can Canada depend upon securing sufficient numbers of these health workers from other countries to meet our needs.

There is perhaps a need to alert planners in the field of Medical Rehabilitation, who are concentrating on efforts to cope with the adult problem, to not overlook the need for habilitating disabled or crippled children. Efforts to salvage the health of children are probably the most productive because their lives are still ahead of them and because they are at an adaptable age when treatment and habilitation can achieve spectacular and far reaching results. While some saving and efficiency may result from combining adult and child

habilitation facilities, it is not clear that a case has been made for complete fusion of the two. Perhaps the children will receive early and more complete care if a major part or all of their facilities are emphasized separately.

Most health workers are aware of Canada's adverse position in having an infant mortality rate higher than eleven other countries in comparable circumstances. In 1953, 14,764 infants died during their first year of life and of these 8,895 died in the first month of life. Certainly, here is an unmet need.

Evidence is accumulating to show that if facilities for good health are focussed on the children, whereby they attain improved nutrition, correction of defects and freedom from infectious and other diseases, the resulting cohorts of children will move forward through life, and given a comparable environment, will experience less illness, less absence from work, more adult productivity extending further into old age, and they will die at a later date. With this long term concept, it would seem that everything possible should be done in any province to provide the utmost in good health for the children.

Good health for the children starts with good health for the mother. Perhaps many of us tend to overlook that there is still a wastage or unmet need in this field, highlighted by a level of 324 maternal deaths in 1953. Adequate prenatal, obstetrical and post-natal care are of the greatest importance and must be sought after diligently by all concerned.

Only four provinces had nursing consultants in Maternal and Child Health in 1954. Six provinces had Divisions for Maternal and Child Health under medical direction, and two others had the consultant services of paediatricians. The extension of full time health units throughout all areas of Canada, with suitable emphasis on the health of mothers and children is a real necessity. The co-operative effort of physicians, hospital personnel and public health workers is necessary for a concerted and long term effort in providing improved health for Canada's mothers and children.

Although not accepted by all as a health department responsibility, accidents in the home and on the highway are on the increase. Motor vehicle accidents resulted in over 3,000 deaths in 1953, which is said to be almost 60% of all accident fatalities for that year. Accidents involving children have risen in several provinces to become the leading cause of death in children. We live in an age of speed both on the ground and in the air and may be on the verge of travel in space. What this will mean in terms of further stresses for the human body can only be conjectured.

One of the first and most common diseases attacking our people is tooth decay. At two years of age one child in three has dental cavities; at three years of age three children out of five; at four years seven children in ten; and, by the age of sixteen, more than 95% of Canadians have experienced tooth decay. Here is a vast field of unmet needs in health care, not medical in the sense of being provided by medical practitioners but of far reaching importance to the health of our people. Not enough dentists are being trained to keep abreast of replacements, not enough dental hygienists are being trained to participate in large programs for preventive dental care in children. We are assured that a start should be made with the earlier age groups and maintained on into adult life.

Of all families reporting under the Canadian Sickness Survey, only 27.6% reported expenditures on dental care, rising from a level of 14.2% for incomes under \$1,500 to 45.8% for incomes over \$5,000.

Canada's present advantageous position in the control of communicable disease is maintained at the price of constant vigilance, effort and organization, to prevent the outbreak of diseases like smallpox, diphtheria, pertussis, typhoid fever and others, while at the same time maintaining full scale programs at considerable expense for the unremitting control and suppression of such diseases as tuberculosis, venereal disease, and perhaps of poliomyelitis.

As an illustration of the constant vigilance that is required we are told that in five provinces in 1954, the rates in one or more categories of venereal disease were slightly higher than those for 1953.

The campaign to wipe out tuberculosis in Canada as well as in other countries is one of the most dramatic success stories of modern public health. It is estimated that final calculations for 1954 may show the mortality rate for tuberculosis to be slightly in excess of 10 per 100,000 of population, decreasing by 76.3 per cent in the last seven years. Planners are already encountering empty beds in sanatoria and suggesting that they be turned to the care of chronic or mental patients. The question is now being asked: "Can tuberculosis be made as rare a disease as typhoid fever is in Canada at this time?" There is accumulating evidence that this can be accomplished.

Although authorities agree that the first evidence of declining morbidity for tuberculosis is apparent, words of caution are also in order. The seriousness of tuberculosis for the individual may be lessening but the control of tuberculosis is likely to be attained only through continuous and undiminished effort. Too rapid a reduction in our programs could jeopardize our goal of elimination of the disease.

Because ophthalmology is largely a specialty, many of us are only partly aware of the health problems associated with diseases of the eyes. Our recognition of unmet needs must include the development of suitable glaucoma clinics in the larger centres in Canada similar to those already operating so successfully in Toronto and Montreal, travelling eye-clinics for remote areas and the extension of screening procedures for the vision of all school children. A recent pressing need has developed for corneal transplant tissues for modern techniques in surgery. Perhaps early action could be taken in each province to secure these tissues to meet the demand.

In spite of the increased prosperity of our people and the accessibility of all foodstuffs necessary for optimum health through nutrition, nutrition experts are concerned on the one hand at the evidences of overweight through overeating by perhaps 25 to 30% of our population and, on the other hand, concerned over dietary deficiencies through inadequate diets.

Experience in the United Kingdom has indicated that hospitalization and medical care plans should include, or even be preceded by a properly organized diagnostic services program. It should also be noted that each Province in its Health Survey Report recommended that better diagnostic services be provided as a prime requisite for the improvement of province-wide health programs.

Diagnostic procedures were defined for the purpose of the new federal Grant, as those procedures ordinarily requested by a registered medical practitioner and performed by workers employed in institutions approved by provincial authority, for the purpose of assisting the physician to diagnose the presence, absence or status of disease, defect or disability.

The Laboratory and Radiological Services Program is still in the early tooling-up stage. Much remains to be done to bring within the reach of all doctors and their patients, even in remote rural areas, the wide range of accurate diagnostic aids essential to the practice of modern scientific medicine and for which our doctors have been trained.

During the seven years since 1948, provincial and local endeavour stimulated by the federal assistance available under the Hospital Construction Grant has resulted in the addition of hospital space for more than 54,700 new adult patient beds, 6,600 bassinets in nurseries, 8,500 beds in nurses' residences and floor areas amounting to 1,292,000 square feet in community health centres and laboratories.

Representatives of the Canadian Hospital Association estimated in 1948 that Canada would require 40,000 hospital beds of all types in the next five years and that a full 60,000 would be required by the end of ten years. Federal assistance has been approved during seven years for approximately 60,000 beds of all types.

It is estimated that there are in operation, or soon will be completed, a total of over 83,000 acute care beds, or a rate of 5.2 beds per 1,000 of population, and over 12,300 chronic and convalescent beds, or a rate of .8 per 1,000, making a total rated capacity of 85,300, or a rate of 6 per 1,000, excluding beds in tuberculosis sanatoria, mental institutions and those operated by departments of the federal government.

If a rate of 7 beds per 1,000 is to be considered as optimum for acute and chronic beds, then, according to our calculations three provinces have now reached this level and the remaining provinces require the construction of additional chronic beds to reach the level. There is some indication that hospitals with smaller rated capacities do not maintain the high level of occupancy that is characteristic of larger hospitals.

Thus the need for building acute treatment beds is falling off in most Provinces. With bed ratios approaching five beds per thousand for acute treatment care, planning committees in each province are paying more attention to the proper distribution of beds in previously unserved areas. However, it should be remembered that Canada is a growing country with a natural increase of between 400,000 and 500,000 in population per year, which, on a 5 bed per 1,000 basis, could mean an annual construction program for acute treatment beds of as many as 2,500 beds. This is in addition to the need for replacement of obsolete facilities after decades of use.

There is currently a mounting pressure within the provinces to undertake the construction of additional chronic, mental and custodial care accommodation.

For the most part, local communities focus their attention on the acute treatment facilities and look to governments and to voluntary agencies to provide

accommodation for chronic and custodial care. It is difficult to estimate the total chronic care bed-need in the hospital field, since many custodial care facilities, operating under the supervision of departments of Welfare and of voluntary agencies, provide partial accommodation for what might be termed chronic care patients. This area desperately requires exact definition, concerted planning and early action. The shortage of chronic care facilities at two beds per thousand is said to be approximately 15,000 beds, after present construction is completed.

Much is said about the need for additional mental care facilities. One notes that many authorities suggest a minimum of five beds of custodial and treatment care per thousand of population for these patients. Other authorities suggest many additional beds are required, reaching as high as 10 beds per 1,000, or twice the recommended optimum for acute general hospital beds.

A conservative estimate of 3.5 beds per 1,000 for psychotics, 1.5 beds per 1,000 for mental defectives, 1.2 beds per 1,000 for epileptics, totalling 5.25 for all types, provides a working estimate in determining present bed shortage in mental institutions in Canada at 17,000 or more beds. Unfortunately, a large proportion of the accommodation presently in use is obsolete and a rapid increase in population may mean an accelerated program of building mental care facilities for many years to come.

In the consideration of unmet needs for hospital construction it should not be forgotten that modern therapy, and the growing dependence of physicians and their patients on the hospitals as centres of community health services, will continue to require that each hospital emphasize at all times a high standard of efficient operation, both in terms of standard of service and in cost of operation. The recent drive for accreditation and the introduction of uniform cost accounting procedures are worthy of support.

Those who are responsible for the planning and operation of health facilities will no doubt say that the greatest unmet need in the health field is that of finding sufficient well-trained personnel to get on with the job. It is perhaps a truism that any health program is only as good as the services of the people who staff it. Sound training, broad practical experience, adaptability and soundness of judgment are essential.

While there may be a reasonable supply of physicians over all there is said to be a mal-distribution of general practitioners in some areas and perhaps a tendency to develop what has been called the specialties out of proportion to the numbers of general practitioners. Students of medical history have suggested that this emphasis on specialists occurs during prolonged periods of prosperity and tends to correct itself whereby there are more general practitioners during long periods of recession or of less prosperity.

The most acute shortages in the nursing field are said to be of teaching personnel for the hospital schools of nursing and of public health nurses to take advanced courses to prepare for supervisory administrative posts. While there is an overall shortage of nurses, a situation which may remain with us for several years to come, there is an improvement in the number of nurses available for general duty in the larger urban areas.

In our modern approach to health, departments of health have been allotted

an increasingly important place in the provincial and local community budgets. At times, it has been necessary for provinces to carefully scrutinize this position in order that a proper balance may be maintained in expenditures on welfare, education, highways and the development of natural resources. Doctor Lloyd Francis has reported that health services now absorb almost exactly 4% of national income. All personal health care expenditures in Canada in 1953 totalled about \$750,000,000 of which the consumer made a direct expenditure of 50%, while governments paid 33% and voluntary insurance plans 17%. In the Canadian Sickness Survey it was demonstrated that each Canadian family directly spent an average of \$82.10 on health care, while the 86.4% of families that did have health expenditures spent in each family \$95.00 during the year.

In 1953, public and private hospitals received about \$263,000,000 of which the patients paid 36%, while 24% was paid by voluntary plans, 19% by provincial hospitalization plans, 11% from per diem grants and donations, 6% from governments or special groups, and 4% from Workmen's Compensation Boards. In the same year, the physicians in practice are said to have received about \$170,000,000 of which their patients paid 61%, voluntary insurance 25%, government plans 8% and Workmen's Compensation Boards 6%.

These are large expenditures in the budgets of our people and since there are many unmet needs in health care they may go higher. The question naturally arises whether present expenditures can be made more efficient in securing the best in quantity and quality of health care, with increased accessibility of service and efficient administration.

Canadians are a progressive people, interested in social welfare. It can be expected confidently that they will demand the best in health care at all times. It will be our job as planners, administrators and providers of service, to evolve for Canada the most efficient organization for the highest standard of health care that is possible.

Perhaps, during this period of accelerated expansion and development of health facilities our difficulties in meeting unmet needs are, in fact, assets, in that programs for health are carefully scrutinized, with available personnel and equipment channelled to the areas of greatest need and providing overall for orderly and desirable growth.

A Physician Looks at Fluoridation

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IN my memory, no single subject in the field of public health has received so much attention in the professional and lay press as the fluoridation of communal water supplies. Nothing in recent years has raised as much public interest. The whole subject has become so beclouded with emotionalism, there are so many claims and counter-claims that the average layman finds it difficult to decide what he should believe. A new disorder of the human mind is currently affecting a sizeable segment of our Canadian population, the condition of 'fluoriphobia.' Perhaps we can prevent the spread of this malady and even cure some of those presently afflicted.

I would propose to approach my subject under certain broad headings. Since we are primarily interested in the effect of fluoridation on dental caries, I will present to you the most recent data on the problem of dental disease among our Canadian people. I will rapidly review the measures, other than fluoridation, which are available to us for the control of dental caries. We will then consider the history of and the results attained from fluoridation in the United States and Canada. Finally, I will consider the difficulties you are likely to encounter in your own community and how you, as a public health worker, should anticipate and meet the challenge. Make no mistake, upon your shoulders will rest the fate of fluoridation in your own community. As in all other great health advances, it is the public health worker who must provide the leadership, the direction, the coordination and the integration of community interest.

Is dental ill health truly a public health problem? Practically every Canadian, during his lifetime, experiences tooth decay or gum disease. In the typical community, over 98% of the school children will have tooth decay, many with subsequent jaw abscesses and tooth loss. Diseases of the gums are widespread among adults, with a good proportion due to early loss or mutilation of the dentition by decay. The Canadian Sickness Survey of 1950-51 (1), showed that dental care made up 8.8% of the total health expenditure. Out of a total health care bill for the Canadian people of \$373.8 millions, dental care accounted for \$32.9 millions. The average expenditure per Canadian family for dental care was \$7.20. It must be remembered that this was the actual cost of

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dental care given and not the cost of the care that was needed. In a survey carried out by the Canadian Dental Association in 1954 (2), it was shown that the total cost of dental care in Canada in 1953 was \$73 millions.

There have been many surveys made on the prevalence of dental caries among school children. A composite of those surveys shows that at school entrance the child has 3 carious teeth, at the age of 6, 20% have decay of permanent teeth and 80% have decay in the deciduous teeth. By 12 or 13, the average child has 5 of his permanent teeth affected and 65% have had decay experience in the permanent dentition. Sixteen year olds have 7 teeth affected, and in the late teens and twenties it ranges from 9 to 16 (3).

Surely, by whatever means we define a public health problem, dental disease fulfils those criteria. Whether we define it on the basis of the number of people affected, on the misery and ill-health it causes or on the resultant economic burden, dental ill-health is truly a public health problem in Canada today.

What means other than fluoridation are available to us for the prevention and treatment of dental disease? The three most important are probably nutritional control, oral hygiene and treatment.

The current argument over fluoridation has tended to distract attention from the alleged role of refined sugar in the production of dental caries. There is much evidence that it is important. It is well known that caries rates in children on a wartime diet low in sugar were universally lowered, a group of children in Australia brought up on a diet free from refined sugar had an extraordinarily low caries rate as have diabetic children on a low carbohydrate diet. However, Clements (4), sums up the practical difficulty well when he says: "The high esteem and social acclaim of a set of sound teeth are still not adequate to serve as motivation for the restriction of a substance associated in the public mind with rewards, pleasure, and oral gratification."

A few dedicated enthusiasts like McGregor in Toronto or Honey in Welland may succeed in influencing a relatively small segment of the population but it will never be possible to apply this on a national basis. We may think it is difficult to get people to accept fluoridation in the interest of their children's teeth; it is a vastly easier task than to get them to stop their offspring from sucking candies all day long. Such an authority as Becks (5), appears to accept the inevitable in his statement: "It is our belief that this procedure (restriction of refined sugars), should apply only to rampant dental caries cases in which the life expectancy of the denture, because of the development of many cavities, is greatly endangered."

As late as 1947 there was no scientifically acceptable evidence of the usefulness of tooth brushing as a caries-preventive measure. Since that time Fosdick (6), in a study of college students, showed that tooth brushing, in itself, might be useful in checking the development of dental caries if practised *immediately* after eating and drinking. The addition of specific agents to dentifrice preparations has met with equivocal success whether that substance be penicillin, chlorophyll, or the ammonium ion. The difficulty of achieving immediate brushing after every intake of food or drink is too obvious to require any elaboration.

If a child receives early, adequate and continuous dental care he will be

spared many of the ravages of dental disease. But, consider for a moment the difficulties that lie in the way. Think of the tremendous educational program that would be necessary to convince the average parent that his child should be under continuous dental care from the age of 3 onwards, an objective we have not even attained for the school age child. Consider the tremendous financial burden that would be placed upon the parent. Even if the parent were willing and able to do this, is the dental profession in a position to give the necessary service? In the City of Vancouver and in the Province of British Columbia, we are in the most favorable position in Canada. In the city the dentist-population ratio is 1/1,449, and in the province, 1/2,205, as contrasted to a national ratio of 1/2,790 (1954). It is exceedingly difficult to quote a realistic and desirable dentist-population ratio. In World War II, the Canadian Dental Corps was established on a ratio of 1/650, an ideal that was never attained. The five dental schools in Canada in 1954 graduated 174 students. In the previous year, Canada's population increased by 350,000. If we assumed that a dentist could care for 2,000 people, a manifestly absurd figure, 175 additional dentists would be required each year simply to take care of population increase and this would do nothing to replace those lost by death or retirement or to improve the presently unsatisfactory dentist-population ratio. The dental profession, up until the present, has been fully occupied in repairing the ravages of dental disease. There is little or no prospect of this situation changing unless we attempt a preventive approach.

All of these things: dietary control, oral hygiene, and treatment are important and must not be neglected but, in themselves, are completely inadequate to deal with the problem of dental disease. The use of fluoridated communal water supplies is the first realistic approach to the solution of our present difficulties.

Black (7), of the University of Florida, has called fluorine the "Blessed Impurity." When the opponents of fluoridation talk about our lack of knowledge they display complete ignorance of the years of research behind us. I know of no public health procedure that has received as long, as complete, as thorough and as convincing research as has the subject of fluoridation of communal water supplies.

Attention was first drawn to the presence of naturally occurring fluoride ion in water in Colorado in 1908 when McKay (8), and his co-workers observed mottling of the enamel of the teeth. Fluoride was not definitely proven to be the etiological factor until 1931 when Churchill (9), showed that the fluoride ion was the cause. Shortly, Dean and Elvove (10), reported that concentrations of fluoride of 1 p.p.m. or less would not cause mottling. The same workers showed that (11), tooth decay among children drinking water containing 1 p.p.m. of fluoride was about 60% less than among children who drank water containing no fluoride. It soon became evident that fluoride was a fairly common constituent of natural waters. In the United States, 631 public water supplies, serving 1,486,847 people contain natural fluoride in excess of 1.5 p.p.m., and 1,401 public water supplies serving 4,188,000 consumers contain more than 0.7 p.p.m.

However, many public water supplies contain little or no fluoride. It was inevitable that the next obvious step was to add fluoride to those supplies which were deficient in that constituent. In 1945-46 this was begun in Brantford, Ontario; Grand Rapids, Michigan, and Newburgh, New York. In the United States at the present, more than 1,000 cities are fluoridating their public water supplies.

What have been the results of artificial fluoridation of communal water supplies based upon the experience of ten years? Basically the results have been identical to those already observed in those areas which have had naturally occurring fluoride in their drinking water for many years. For more detailed results we will look at the experience of Brantford, Ontario. Brantford began mechanical water fluoridation in 1945 and the results cited are from studies closely supervised by the Dental Division, Ontario Department of Health, and by the Research Division and the Dental Health Division of the Department of National Health and Welfare. Two nearby cities, Sarnia and Stratford, alike in all respects except for the fluoride content of the drinking water were used as controls. Sarnia has little or no fluoride in its water supply. Stratford has naturally occurring fluoride of 1.3-1.6 p.p.m. and this supply has been continuously in use since 1917. The fluoride content of the Brantford supply has been kept at 1 p.p.m. since 1945. Large, comparable samples of children from each city have been examined in four subsequent surveys.

The results cited here (12), are from the survey of 1954. Each year surveyed (1948-51-53-54), has shown a steady decrease in caries in Brantford. In 1948, Brantford and Sarnia, the fluoride-free control, showed almost identical figures for caries. By 1954 the proportion of Brantford children 6-8 years with caries free permanent teeth was about twice as great as for Sarnia. The mean DMF tooth rate per child age 6-8, in Brantford was less than one-quarter of the Sarnia rate for that age group. The 9-11 and 12-14 age groups in Brantford had already received considerable benefit by 1954, but not as much as the 6-8 year olds since they had not been drinking fluoridated water through the entire period of enamel development. The Stratford data is used to indicate the full improvement that may be expected.

From 1948-54, dental caries among Brantford children has been reduced by approximately 69% in the 6-8 year age group, by 44% in the 9-11, and by 36% in the 12-14. During the same period, the caries incidence in the 2 control cities has remained at the same level or increased slightly. In 1954 there was no longer any difference in incidence or prevalence of dental caries in the 6-8 year age group in Brantford and Stratford. The gap between dental caries level in the older age groups in Brantford and Stratford has narrowed considerably.

No ill effects of fluoridation have been observed. In all three cities, including Sarnia, there have been a very few cases of slight mottling of the teeth detectable only by an experienced observer. No other adverse effects of any kind have been observed and the Medical Officer of Health and the Medical Staff of the Brantford General Hospital have gone on record to that effect.

The original cost of installation of the equipment in 1945 was \$448 and the engineer, Mr. D. B. Williams (13), estimates that the cost now would range

from \$300 to \$3,500 depending on type of equipment, total feed capacity, etc. The cost per capita has ranged from 11 to 17 cents per year. No difficulties have been encountered in operation.

Here, then, is a Canadian city with an experience of ten years with an artificially fluoridated water supply, an experience which is matched by several American cities. No untoward results have occurred. There has been a two-thirds reduction in the expected caries incidence in those children who have drunk this water during the period of enamel formation. The operation from the mechanical viewpoint is simple and cheap. Why is there still controversy about fluoridation, why has it not been installed in all our communal water supplies?

Who are the people currently in opposition to fluoridation? A sizeable group is made up of those who are uninformed or misinformed on the subject. These are the people who are interested but do not have the time or the opportunity to study the evidence. In this group you may even find a few physicians and dentists. There are those who have been led astray by baseless allegations from those actively opposed to fluoridation. You must concentrate your efforts upon those who are uninformed or misinformed, you have little hope of changing the minds of those who are in active opposition. The only importance of the hard core of opposition is to see that their false propaganda does not influence the average citizen who is sincerely interested in obtaining accurate information. The active opponents of fluoridation come from a variety of sources but, basically, they are the same groups that have opposed every other worthwhile and progressive health measure; they have opposed pasteurization of milk, chlorination of water, diphtheria toxoid, smallpox vaccine. There are those who have a financial interest in opposing this measure; the vendors of faddist foods, the sellers of pamphlets. There are the marginal practitioners who always oppose any advance advocated by the recognized healing professions. There is another group which uses the fluoridation issue, as they would any other controversial subject, for the promotion of their own political ends. Finally, there is a group who for their own devious ends will misquote statements made by normal people, lift statements from the context to give a false meaning, and who appear to have, as their primary purpose, the acquisition of notoriety. You must realize from the outset that you are operating under a handicap in dealing with these people. Your statements must be limited by the scientific evidence available to you. They have no such limitation, the only limit they have is their imagination. They exploit to the full the Hitlerian technique of the big lie knowing full well the tremendous difficulty of refuting a statement that has once been made and disseminated. They use all the techniques; fear hypnosis, the menace of communism, civil liberties, the religious motif, and many others. On the other hand, do not undersell the intelligence of the average citizen. He is hungry for information and if he is given the truth, I am confident that he will ultimately make up his mind intelligently.

As public health workers, we have always maintained that the educational approach was much more important than invoking a measure through legislation. Nowhere is that more true than it is in regard to fluoridation. The public

must be adequately prepared through education long before any legislative measures are taken. If you do not lay a solid foundation of education you will find yourself in the same position as the small Massachusetts town, where after fluoridation was roundly defeated in a vote had this to say (14): "They recognized a basic error in strategy in bringing the issue to a vote without a long and thorough campaign of education. Failing this, they found they had a tiger by the tail."

There are many in the community who can be of help to you in the dissemination of this information; the practising physician and dentist the chemist, the engineer, and many others, but the ultimate responsibility will be upon you to see that the public gets accurate, unbiased information through whatever medium is practicable in your own local surroundings.

I propose to deal with some of the more common statements made by the anti-fluoridationists. It would be impossible to cover them all but I will select those that constantly recur and attempt to give authoritative refutations.

There is not unanimously favourable opinion in the medical and dental professions regarding fluoridation.

When we reach a completely unanimous opinion in regard to any subject the millenium will have arrived. All the great medical and dental associations in North America have endorsed fluoridation, no reputable organization has ever condemned it. The heads of the Departments of Preventive Medicine in 75 Universities in the United States and Canada have endorsed this measure. When someone is quoted as being opposed to fluoridation, enquire into his background. A crackpot in his home town becomes an expert when he is quoted 1,000 miles away.

Fluoridation constitutes mass medication.

Religious freedom is one of the basic tenets of democracy and we must recognize that there are groups in Canada opposed to any forced mass medication. But fluoridation is not mass medication, it is prevention in the truest sense. It is no way different to the addition of chlorine to water, iodine to table salt, additives to refined white flour, or orange juice or cod liver oil to growing children. Further, in many areas, nature herself adds fluorine, all we are trying to do is to bring up to nature's standard those areas that are deficient.

Fluoride is a deadly poison

A perfectly true statement until it is examined. Certainly it is used as a rat poison in certain concentrations. But it has been amply proven that the recommended concentration of 1 p.p.m. is perfectly harmless, the machinery for dispensing it is simple, accurate and fool-proof. Its use is analogous to the drugs in the physician's bag; many of these are deadly poisons if used in sufficient quantity but are life-savers if properly used. At a strength of 1 p.p.m., it would take 10,000 glasses of water at one sitting to poison an individual. It would take 600 tons of the compound to poison the water supply of Toronto for one day.

Fluorine causes illness and premature death

The opponents say that fluoride causes illness and death and is an accumulative poison. There is absolutely no reputable evidence to back up that statement. The question is, whose evidence will you believe? If you will accept the statements of the American Cancer Society or the American Commission on Chronic Illness, you will find that both these bodies have issued definite statements that there is absolutely no evidence that fluoridation of water has any effect whatsoever on the incidence of illness or premature death. Closer to home, I have cited the statement of the Medical Officer of Health of Brantford and the Medical Staff of the Brantford General Hospital that, after ten years, they have seen no evidence of any ill-effect. Perhaps the most authoritative study ever carried out was that by the United States Public Health Service (15). They compared 64 cities in 16 states, half with non-fluoride and half with fluoride containing water supplies. There were nearly a million people in the fluoride cities, and over a million and a quarter in the non-fluoride cities. They studied the deaths from all causes. Here are their conclusions: "These data show no statistically significant difference between the mortality rates of fluoride and non-fluoride cities for all causes, or for heart disease, cancer, intra-cranial lesions, nephritis or cirrhosis of the liver."

The use of fluorine in the water is wasteful and costly, it could be used in some other vehicle

I have quoted to you the Brantford costs—11 to 17 cents per year, less than the price of an ice cream sundae. I have also quoted to you the cost of dental care, on the average, in 1951, to a Canadian family as \$7.20. Even this figure is probably low in light of the report of the Canadian Dental Association in 1954. I have also shown that if a child drinks fluoridated water during the period of development of the enamel, his expected caries incidence will be reduced by two-thirds. Therefore, I submit that fluoridation of communal water supplies is actually a tremendous saving to the taxpayer. Most of the fluoridated water goes down the drain, but isn't it worth wasting a few cents worth of fluoride a year to save many dollars in dental care? Other vehicles could be used for fluorine, but as yet, we have no other substance in universal use which will reach all those who need it regardless of their financial circumstances.

Fluoridation is illegal and an invasion of personal liberty

To the best of my knowledge, no case has reached the Canadian Courts in an attempt to prove that fluoridation is illegal but there have been rumours that such may occur. In the United States up until the end of 1954 (16), there had been rulings favourable to fluoridation in eleven different states and in the United States Supreme Court. All court decisions handed down have been favourable to fluoridation. In a democracy the will of the majority must rule. After the general public have the facts and make the decision for themselves, then that decision must be upheld even though it may be undesirable to a minority. On this simple basis is democracy founded and no splinter group

within our country may be allowed to impose its will upon that of the great majority.

I have given you only six of the favourite arguments of those opposed to fluoridation. All the rest follow a similar pattern. There are many sources of reputable information available to you, use them to the full. Be factual, firm, pleasant and use every opportunity to get the information to your people.

In such a brief presentation it would be impossible to cover all the ramifications of this vast subject but the points I wish to make are:

1. Dental disease is one of our major public health problems.
2. The traditional methods for control presently being used are inadequate.
3. Fluoridation of communal water supplies is the first realistic approach to the prevention of dental caries, it is effective, it is safe, it is cheap.
4. A small vocal minority oppose fluoridation.
5. It is the duty of the public health worker to do everything in his power to educate the public to accept fluoridation.

Let me end with a quotation from Sir William Osler: "There is not one single thing in preventive medicine that equals in importance mouth hygiene and the preservation of the teeth." What better summation could there be for the tremendous importance of this subject?

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Chronic Disease Care: The Next Milestone

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THE tide of human events rarely stands still and society is faced with the phenomenon of great areas of social and economic concern which arise, often directly, as a result of its previous efforts. Because of the great diminution and, in some instances, virtual disappearance of those acute illnesses which extracted a high death toll of our young people heretofore, we are now faced with a growing problem of chronic disease. Credit for this achievement can be shared by the developments in preventive medicine and the provision of better medical care made more freely available. It therefore seems apt that a medical care conference should study the problem of chronic disease as a present and future concern.

The problem of chronic or long-term illness has always been with us; indeed the impact of some chronic diseases such as tuberculosis, leprosy and syphilis has been met and these are becoming of lesser importance in our society. The problem as a whole, however, is growing in importance and it is felt that we who are interested in the provision of medical care and the health of the public should devote some time to considering the implications of the problem.

In order that we may truly confer on the subject of chronic disease it is perhaps unwise to attempt a definitive review of the whole problem; an attempt will be made, rather, to delineate some of the important aspects of chronic disease which will serve as a basis for an interchange of opinion and act as a stimulus to our thoughts.

In looking over the voluminous literature on chronic disease one is impressed by the fact that there is no commonly agreed upon definition. We tend to talk without clear semantic referents about long-term illness, incurable illness and chronic disease, never being certain where the definitions overlap. In some instances the length of time a person is incapacitated is the criterion which is used; in other cases the extent and permanency of the disability is the relevant defining factor. It is probably quite important for those of us interested in the provision of medical care to come to a generally accepted definition of what we mean by chronic disease. Someone has said that it can be defined quite simply as being a disease which lasts too long.

The 1951 Conference of the Commission on Chronic Illness in the United States adopted a set of working rules which might be paraphrased as follows:

Presented at the Second Canadian Medical Care Conference, held in the Macdonald Hotel, Edmonton, September 9, 1955, in conjunction with the forty-third annual meeting of the Canadian Public Health Association.

Chronic disease may require long periods of supervision, observation and care, it may cause alterations in body structure and function which cannot be reversed but which may be alleviated, it may result in permanent impairment or residual disability and may require special rehabilitative services. This seems to be a fairly acceptable way of describing chronicity with the major emphasis on the fact that some permanent effect, either social or physical, results.

For a variety of reasons the extent of chronic or long-term disease in our community is difficult to measure. It is difficult to do other than work on a sample basis using tools which are subject to a fairly large error. Our lack of an agreed upon definition or classification has compounded the problem of getting comparable data for measurement.

Some useful studies have been done which indicate the extent of the problem. The Canadian Sickness Survey will provide Canadians with a comprehensive picture of the volume of sickness in Canada. Some of the relevant materials available at this time from the Sickness Survey studies are the national estimates on physical disabilities. From the definition of physical disability used in the Sickness Survey it would appear that the Canadian estimates of physical disability will be less than the number who would suffer from chronic disease. Nevertheless nearly a million people are estimated to have residual disabilities of which 423,000 are severely or totally disabled. Certainly a fair proportion of these persons have static disabilities which require little or no continuing treatment, but an estimate of these is not available. It should be noted that the Sickness Survey does not cover persons who are already in institutions.

Estimates have been made in the United States that about 3.5% of the total population suffers from disabling long-term disease or impairment. Excluded from this group is an additional 15% of the population whose impairments resulting from chronic disease, injury or congenital anomaly are minor, and for which short-term care is available in most communities as required.*

To apply these figures to Canada, we could estimate that about 530,000 persons in Canada suffer from disabling chronic disease and impairments and an additional 2,250,000 have minor degrees of disability.

These calculations are admittedly very rough but serve to point out the seriousness of the problem. As our interest in the problem of chronic disease and impairment increases, it follows that we will be able to estimate the prevalence more accurately.

There would seem to be little doubt, too, that the prevalence of chronic disease will become greater in the foreseeable future.

It need not be pointed out to this group that the prevalence of chronic illness is higher in the old age groups. According to the Sickness Survey over two-thirds of the severely and totally disabled are aged 45 or over and more than one-third are over age 65. Similar figures are available elsewhere.

What may not be as apparent to all of us is the rate at which our popu-

*Care of the Long Term Patient—U.S. Department of Health, Education and Welfare, U.S. Government Printing Office, Washington, 1954.

lation is ageing; certainly it is not viewed with any sense of urgent concern by many of us. Nevertheless in the short period of 1947 to 1953 the number of persons age 65 years or over increased by over a quarter of a million in Canada. While our total population increased by about 21% in seven years, the number of persons over 65 increased by 28%. And let it be recalled that this change occurred in an era when our birth rate was at a very high level.

There can be no doubt that our society has a responsibility to face this problem objectively perhaps sooner than we would like. It becomes the task of those of us interested in medical care and the welfare of the public to carefully consider our responsibilities and the contributions we can make.

Perhaps as we try to analyze the reasons for doing as little as we have up to now about chronic disease, we are forced to recognize that there are two main components to the problem—the first which might be called the scientific or therapeutic aspect and the second, the administrative aspect.

The development of an administrative mechanism to provide chronic disease care presents many intriguing possibilities which will challenge our resourcefulness for some time to come. It will perhaps be useful to give our major emphasis to some of these administrative problems.

Chronic disease is, with few exceptions, the outgrowth of our inability to successfully handle the acute phases of disease either therapeutically or administratively. Our failures to prevent the onset of residual disability and of chronicity has made those in medical practice and those in administrative posts prone to relegate the problem of chronic disease into the category of those things we can defer or are unwilling to tackle. All of us are aware of this almost universal failing, yet we seem to become quite adroit at finding ways to temporize and excuse ourselves. All evidence points to the fact that this has occurred in relation to chronic disease and demonstrates the growing urgency of the need for bold and decisive action in meeting the problem head on.

But as we head into the solution of the problem, we must be wary of several things which can easily happen and, in fact, have happened all over the world. Patients with long-term illness can deteriorate at a truly remarkable rate and this deterioration is not explainable solely on medical grounds; rather it is a process of emotional and psychological stagnation. One is impressed by the utter lack of any spark of incentive, or even interest in living, in a large proportion of the people in almost every chronic disease hospital one visits. It seems obvious that this should not necessarily occur.

If we are to solve the problem of chronic disease we must be careful that we do not continue to allow our patients to become institutionalized. Not only must we rectify some of the mistakes we have made in the past and are still making, but we must plan carefully and soundly for the future.

We will require a good deal of effort to develop understanding of the problem ourselves and to relay that understanding to others. Only when it is recognized that chronic disease is not synonymous with hopeless disease can we expect to move forward to real progress. That recognition is slowly growing in professional health circles but there is still, I fear, an enormous apathy in the public mind. The time is at hand for a major effort and we who are in-

interested in the provision of medical care and the health of the public must be in the forefront of the attack.

There are certain general principles that I feel we can agree upon and which are put forward here as a basis for later discussion.

As one thinks of the problem of chronic illness and disability it becomes evident that the care of the chronically ill cannot be isolated from the whole field of general medical care. To isolate it as something apart is likely to lead to serious dangers of deterioration of the quality of care and to medical stagnation of the patient. While it is theoretically possible to set up a program for chronic care which will be effective, it seems unlikely that such an approach will be routinely or even frequently successful. It is admitted that there are many special features in the handling of chronic illness but, in the main, the medical problems are fairly straightforward. It seems to me that certain further general conclusions can be drawn if we accept this thesis.

The patient's own physician should participate as continually as possible in the medical care of his patient at all stages of the illness. To enable the physician to do this, steps must be taken to do four things for him.

1. He must be encouraged to adopt a new point of view.
2. He must have his training re-oriented.
3. He must have the necessary resources available.
4. He must be paid.

Along with this goes a second general and interrelated conclusion.

Since most long-term patients can be cared for in their homes, and I would suspect prefer to be cared for there, provision should be made for the wide variety of services required to meet the needs of these patients in their homes.

It will be seen that there is a great deal of interrelationship between these two conclusions. Physicians must recognize to a greater extent than they have that the newer methods of treating long-term illness are effective and desirable and can be carried on at home; they must learn to utilize the skills of the other health professions and social agencies to a greater degree; they must become more aware of the community resources that are available to assist the patient. We, as administrators, must assist the community and the various professions involved to plan the development and means of utilization of the necessary resources. It is only in rare instances that any real efforts have been made to organize and provide a comprehensive service for the physician's use—in most areas little has been done to make available such services as home nursing, social workers, housekeepers, occupational and physical therapists, nutritionists and others.

Then provision must be made to provide those services which cannot be given in the patient's home. In some instances the home conditions are unsuitable or the home nonexistent. Appropriate domiciliary accommodation in institutions will look after many of these patients who may not need care in hospital type surroundings.

On the other hand certain patients will need the kind of care which can only be given in a facility which provides that high degree of skilled attention which cannot be administered in the patient's home or which is uneconomical

there. There seems every indication that such units should be associated with acute general hospitals and, in fact, be a closely integrated part of those hospitals. Administrative techniques must be worked out by which the best use is made of our technical resources, both from the standpoint of time and financing. This implies an expanded use of outpatient facilities and an easy access to the use of inpatient facilities where these are required. In other words, the ideal to be sought is a free movement of patients from one type of facility to another; their home, the acute general hospital, the specialized chronic unit, rehabilitation facilities and purely custodial institutions must all be used as indicated. This will require administrative co-operation and planning of a high order which will permit stepping over many of the traditional boundaries of programs or facilities as they are now constituted.

Plans must also be made which will recognize that care and prevention of chronic disease are inseparable. It does not appear that there will be any spectacular prophylactic measure available for some time at least. But prevention in the sense that early diagnosis and adequate early treatment are available is requisite. The techniques of mass screening need exploration. In acknowledging that there are many problems which will arise in developing mass screening techniques—the foremost of these being the charge of possible interference with the physician-patient relationship—we must acknowledge as well that much of the success which has been achieved in the control of tuberculosis resulted from the employment of mass screening techniques.

Means must be found to provide early case-finding, early diagnosis and treatment. This may involve a major change in our attitude to the degenerative diseases, particularly where little is done at the present time until the process is well advanced. Public and professional interest in finding and treating these diseases must be fostered and stimulated.

It has probably been made fairly obvious from the foregoing that there is much which we do not know about chronic and long-term illness. One always suspects the extent to which a problem has been subjected to analysis when there are no commonly agreed upon terms of reference. Much more research is required and I merely introduce the subject here to remind us that this is one of the most fruitful areas to which a group such as this can contribute.

Basic and applied medical research into the cause and treatment of all types of long-term illness is being extended in a particularly gratifying way. More support for this type of research will be required and some is being provided and will not be mentioned further here.

On the administrative side, however, there are a number of ideas which could be discussed.

The first logical goal for research would seem to be the development of a more accurate knowledge of the prevalence and incidence of long-term illness and impairment. Such studies should be done on a community, as well as a provincial or national basis so that ultimately co-ordinated utilization of the community resources could be achieved. The nature of these studies will vary but, in general, they should provide information which would show the prevalence of existing chronic disease, its incidence, the nature and extent of impairment and disability, the amount of undiagnosed and nonmanifest disease

and the extent of findings or symptoms which may later develop into chronic disease.

With this type of study there should be an evaluation of the economic aspects of long-term disease; the effect on the individual's or family's economic status, the cost of diagnosis and treatment, the adequacy of personal income, insurance and community resources should all be studied. And particularly if we are to help mould public opinion we must find ways to show that better care of chronic disease is economically sound as well as socially desirable. Our first interest will be to measure the programs we may outline in terms of human values, but I suspect that we will find that the benefits in terms of lessened cost and increased productivity will be very substantial.

The wide variety of studies which are needed could be elaborated almost ad infinitum. The important point is that more basic data are needed which must be reported, criticized, analysed and discussed, particularly by groups such as we have here today. Many of the studies required will be extensive but many small-scale projects which can be devised as a form of test-tube evaluation will provide the experimental data for further applied research.

We must advance our knowledge on all fronts, on the medical, the administrative and on the sociological. It will avail little if ways and means of improving the results of treatment are found unless the administrative, the economic and social needs of long-term patients can be met. The various alternative ways in which this statement could be put are equally true. A broad attack on all fronts is imperative and to mount that attack the greatest degree of imagination, resourcefulness and co-operation must be supplied.

Finally comes the question of how we are going to pay for these programs. This field is a most fruitful one for study and I would merely suggest here that there are two main components to the problem which the long-term patient meets—the maintenance of income and the payment of medical and related expenditures. A full solution to the first aspect will have an ameliorating effect on meeting out-of-pocket costs, but it does not appear likely that the financial burdens of long-term care can be met in their entirety by providing for continued income. It seems apparent that there are two main choices; by using the insurance principle or by public expense. Immediately there comes to mind a multiplicity of problems which cannot be resolved immediately but which we should begin to think about within the frame of the chronic disease picture. The means of financing the care required will be as difficult as anything tackled heretofore in the field of health economics. Only by constant and patient analysis, imaginative experimentation and constructive planning can we hope to solve the economic side of the problem we face.

Those who have been interested in the provision of medical care throughout the world have demonstrated that they could answer many of the health needs of our people; meeting the growing problem of chronic disease will require the utmost in skill and resourcefulness; it will be a challenge worthy of all our best efforts.

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IMPORTANT RESULTS IN A STUDY OF ADMINISTRATIVE PRACTICE

WHY are not more studies being made in administration as relating to public health? This question is often raised by Medical Officers of Health as they read of the large number of research projects which are in progress in the laboratory in the study of diseases and in physiology, biochemistry, bacteriology and other basic sciences. The relatively small number of studies of problems in public health administration conducted in Canada reflects primarily the shortage of staff in health departments and not a lack of appreciation of the value of such research. The Canadian Public Health Association and Provincial Public Health Associations have also urged that more studies in administration be undertaken. More is being accomplished by Federal and Provincial Departments of Health and by University departments than is usually credited. In the Department of National Health and Welfare, a major division is engaged in comprehensive studies under the direction of Dr. J. W. Willard. Health Officers are familiar with the reports issued by the Division of Research and Statistics including the highly important study of morbidity in Canada. This required a carefully planned collection of data during 1950-51 and a series of reports presenting a thorough study of the data have now been published. Current morbidity data are essential in the determining of the problem of medical care in Canada and in the planning of prepaid medical care programs as well as defining more clearly the problems of hospital care. The morbidity study was conducted by the Department of National Health and Welfare in close association with the Bureau of Statistics and with the active participation of the ten provincial health departments.

A major contribution in administrative research is being made by the Department of Public Health of Saskatchewan under Dr. F. B. Roth, Deputy Minister, through its Division of Research under Dr. Murray S. Acker. A series of valuable papers have been published relating to the provision of prepaid hospital care, of health services as provided in regional areas and of medical care problems including the findings of a plan of tax paid medical care in the Swift Current region. Other Provincial Departments and several City Departments of Health have conducted studies in special fields and when these are

considered it is evident that a number of important studies have been undertaken. There is, however, great need for the extension of the present efforts.

In this issue, Dr. J. T. Phair, Dr. W. G. Brown and Wm. Nichols of the Ontario Department of Health present an abstract of their extensive report of public health services in Ontario, having particular reference to staff requirements. The shortage of trained personnel has brought before every public health administrator the problem of the more effective use of trained personnel. It has been the usual practice to estimate staff requirements in terms of thousands of population to be served. Such an empirical procedure has long been recognized as inadequate and often misleading. The study made during the past six years in Ontario included the trial of several methods of computing staff requirements. To develop a more satisfactory procedure, an intensive study was made of public health programs in fifteen areas, constituting an acceptable sample of the forty-one program areas under full-time Medical Officers of Health administration. The method developed appears to be adequate and practical. Four services were reviewed, namely medical, nursing, sanitary inspection and clerical. The programs studied varied from completely urban to highly rural areas and the population size ranged from over 200,000 to 15,000. Data relating to activities of the four services were collected in terms of standardized half-days of time with five hundred half-days of service representing one full-time unit of service.

One of the reasons for the inadequacy of the method of estimation of staff requirements in terms of thousands of population served is the difference in the distribution of population which the authors term "population dispersion." The second reason lies in the fact that the calculation does not take into consideration the extent of the public health problem—the need which varies in different areas, even when these areas are in close proximity. The method therefore which has been developed takes into account, population size, population dispersion and the extent of the public health problem. The authors have introduced several new terms. One of these is "additive population." A population road-mile ratio of 100-1 or greater is not considered as presenting a significant travel handicap. Essentially the method used by the investigators calculates the population which would have to be added to a program area to bring the population road-mile ratio up to 100-1. This "additive population" together with the actual population is used to estimate staff needs. This method assured that rural areas would be given a service which compared favorably with that provided in urban centers. Another term "critical statistic" relates to the extent of the need in an area. Services should be allocated according to need. The investigators' objective was to find a single critical statistic related to each field of activity which, among the available and reliable statistics would be the critical statistic for the field. They defined it as unit of population which was significantly concerned in the activities of the staff in that special field. They divided public health services into eleven fields of activity. In tuberculosis control, the critical statistic was a new active case of tuberculosis, in maternal and infant health a resident live birth, and in secondary school health, a secondary school child. The problem of determining a formula method by which, using critical statistic values, the staff requirements for each of the four

services can be calculated was solved through employing regression analysis. This method was selected as it had been found successful in solving similar problems in the fields of agriculture and industry. Statistically acceptable regression equations were obtained in each of the four services under study. By this means it is now possible to calculate the staff time required by any local health agency with due regard to their public health problems for each of the four services. Additional staff time can be determined to compensate for the handicap occasioned by the dispersion of population in a rural area.

The authors stress the fact that the service provided in 1953 may not be an ideal pattern of service. The investigators have not established standards but have developed the method for determining staff requirements. The report indicates what the findings were as applied to the data of 1953. Future work may indicate a different distribution of time. Studies are being continued to determine the minimum pattern of activity which would be considered adequate.

The investigators are to be warmly commended for the studies which they have conducted over the past six years. Their success affords encouragement to all, who pressed by their daily responsibilities still search out new facts and press forward in the endeavour to improve the services for which they are responsible.

THE COMING ANNUAL MEETING

On May 29, the forty-fourth annual meeting of the Canadian Public Health Association with the New Brunswick-Prince Edward Island Branch will be convened in Saint John, New Brunswick. It is planned to hold the third medical care conference at this time in conjunction with the public health meetings. The headquarters of the meeting will be the Admiral Beatty Hotel. Holding the meeting in Saint John will afford our members the opportunity of learning of the important developments in public health in Eastern Canada. Dr. J. A. Melanson, Chief Medical Officer of the Department of Health and Social Services of New Brunswick is President of the Association. The program committee is deeply indebted to the Honorable J. F. McInerney, Minister of Health and to the City of Saint John for the generous hospitality that is being extended to the Association.

A list of accommodation is published in this issue of the Journal and members are urged to make their reservations as early as possible.

**ABSTRACTS OF PAPERS PRESENTED AT THE
TWENTY-THIRD ANNUAL CHRISTMAS MEETING OF THE
LABORATORY SECTION: CANADIAN PUBLIC HEALTH
ASSOCIATION, TORONTO, DECEMBER 12 and 13, 1955**

**The Application of Infrared Spectrophotometry to the Differentiation of
Enterotoxigenic and non-enterotoxigenic Staphylococci.**

F. S. THATCHER, B. H. MATHESON and L. LEVI, *Food and Drug Directorate,
Department of National Health and Welfare, Ottawa.*

PRELIMINARY trials to detect qualitative differences between the infrared spectral curves of lyophilized specimens of fragmented cells or of specific fractions of culture filtrates of enterotoxigenic and non-enterotoxigenic strains of staphylococci were unrewarding, using the silver-chloride disc method of mounting the specimens. However, a quantitative method using KBr discs, and applied to specimens prepared from filtrates by the cold-ethanol method of Thatcher and Matheson, showed differences between the areas subtended by the spectral curves over the wave-lengths 1100 to 1000 cm^{-1} which seemed to be related to the emetic potency of the preparations.

**The Self-Cleansing of Soft-Shell Clams: Bacteriological and Public Health
Aspects.**

I. E. ERDMAN and A. D. TENNANT, *Laboratory of Hygiene, Department of
National Health and Welfare, Ottawa.*

SEWAGE-POLLUTED shellfish are recognized as a serious public health problem. Self-cleansing in natural sea water, under the conditions of the study, was an effective procedure for the cleansing of moderately-polluted soft-shell clams. There was an average reduction of 85 per cent. in the numbers of coliform bacteria in clams cleansed in a semi-commercial study. Repollution of clams under treatment occurred, however, when run-off following heavy rainfall caused a marked increase in the coliform content of the cleansing sea water. Adequate bacteriological control must therefore be provided for any commercial clam-cleansing operation. More than one thousand coliform strains were isolated from sea water and clams during the experiment. Since coliform type ratios were similar in the sea water from the fishing area, the cleansing sea water, and fresh-dug and cleansed clams, self-cleansing of clams did not appear to be accompanied by any significant change in the type distribution of coliform bacteria.

Growth-Curves of *Welchia Perfringens*.

A. FORGET and V. FREDETTE, *Institut de Microbiologie et d'Hygiène de
l'Université de Montréal.*

It does not seem that the rapid growth of *Welchia perfringens* in laboratory media has been related to the 6-hour time limit arbitrarily fixed by surgeons of the first World War for the prevention of gas gangrene by wound excision.

Studies conducted for the "Bursting Factor" from *Welchia perfringens* has led to growth curves which seem to explain for the first time this surgical observation. Graphs are presented for different culture media as well as for diverse containers.

An Interim Report on Ocular Diseases Due to APC Viruses in Ontario.

W. S. AITCHISON and H. L. ORMSBY, *Division of Community Health Services, Department of Public Health, Toronto.*

EPIDEMICS of viral conjunctivitis with corneal opacities occurred in Ontario in 1951 and 1955.

Sera from four patients with EKC in the Windsor epidemic 1951, and from two patients with EKC in Toronto in November 1954, had neutralizing antibodies to type 8 APC (Trimborn) virus of Jawetz.

From November, 1954 to June, 1955 twenty adult patients in the Toronto area with viral conjunctivitis were studied. Half of these patients developed minor corneal opacities, and from eye washings of seven, virus was isolated in tissue cultures of HeLa cells or monkey kidney. Three of these strains were sent to the Virus Laboratories of the National Institute of Health and were found to belong to type 3 APC group of viruses.

A widespread epidemic of pharyngeal-conjunctival fever in children and adults occurred in Ontario in the summer of 1955. This was transmitted primarily in swimming pools and secondarily by direct contact.

Parotitis due to Cocksackie Virus. A Case of Herpangina with Concomitant Parotitis.

F. SOMLO, J. G. HOWLETT and FREDERICK KALZ, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal, Royal Victoria Hospital, McGill University, Montreal.*

EARLY swelling of both parotid areas and a feeling of fatigue was followed a few days later by the appearance of herpangina type of lesions in the buccal cavity.

Cocksackie virus was isolated from material obtained from throat washing and stool.—Complement fixation tests for mumps and herpes gave negative results during and after the diseased period. They remained so even six weeks after the onset of the illness.

Studies on Cocksackie Virus. Infectivity of Kidney Tissue and Urine. Kidney Lesions in Suckling Mice Infected with Cocksackie Viruses.

F. SOMLO, V. PAVILANIS and NICOLLE JONES, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal.*

CERTAIN microscopic changes such as increased size and hemorrhages led us to examine histologically the kidneys of suckling mice infected with Cocksackie viruses. We found a high incidence of glomerular and tubular lesions as well.

To see if the lesions are caused by the localization and direct action of the virus, we carried out a certain number of experiments in which we tried to induce the Cocksackie infection by injecting into new-born mice kidney tissues of previously infected mice. We have transferred the infection in a very high percentage of cases by this method.

Our further aim was to see, whether the urine excreted by these infected kidneys, is capable of carrying the infection. After previous cleaning and disinfection with 2% iodine we stroked the lower abdominal part of infected suckling mice and aspirated right away the ejected urine, on the third and fourth day following the inoculation. We have reinjected into new-born mice and again obtained the high percentage of incidence of infection.

We have infected Cynomolgus monkeys with Cocksackie A3 virus and collected urine by a fine glass catheter on the third and fourth day. The monkeys remained apparently healthy yet their urine contained virus.

We were able to isolate a Cocksackie virus from the urine of a human case of Aseptic Meningitis.

Practical Considerations of the Transduction Phenomenon.

W. R. BAILEY, *Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.*

CERTAIN lysogenic strains of *Salmonella typhi-murium* have been shown to carry a phage that possesses the ability to transduce certain characters from a sensitive host cell to a fertile

recipient cell. An understanding of the properties of such phages has a practical application in a laboratory where serological analysis of *Salmonella* serotypes is carried out.

Strains of *S. typhi-murium* which have been isolated from natural sources have also been shown to carry transducing phages. The possibility of such findings having some effect on our present concepts of epidemiology is discussed.

Symposium: STAPHYLOCOCCAL INFECTIONS IN HOSPITALS.

Experience in Hospitals of the Department of Veterans' Affairs.

Review of present situation and observations on the maintenance of "watching briefs" in hospitals not having any active trouble.

D. H. STARKEY, *Director of Laboratories, Queen Mary Veterans' Hospital, Montreal.*

Report of studies made under endemic conditions—dealing chiefly with sources of infection, depots of infection and barriers to transmission of infection.

J. C. COLBECK, *Chief of Laboratory Services, Shaughnessy Hospital, Vancouver.*

The use of Staphylococcal Phage Typing in Studying Hospital Infections, with comments on present knowledge anent the importance of carriers.

E. T. BYNOE, *Laboratory of Hygiene, Department of National Health and Welfare, Ottawa, Ontario.*

Chairman's appraisal and summary including Review of such outstanding problems as Virulence and Personal Susceptibility. Professor E. G. D. Murray.

The Possible Pathogenicity of Acid-Fast Chromogens.

M. MAGNUS, *Division of Laboratories, Ontario Department of Health, Toronto.*

A discussion of the clinical characteristics and animal pathogenicity of some chromogens isolated in the Central Laboratory and a comparison of them with similar organisms described in the United States and Scandinavian countries.

Correlation between Tuberculin-Hypersensitivity, the Functional Activity of the Reticulo-endothelial System and Tuberculous Lesions in the BCG Immunized Guinea Pigs.

LASZLO KATO and BELA GOZSY, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal. (Presented by László Kátó.)*

TUBERCULOSIS of normal and BCG immunized guinea pigs was influenced beneficially by treatment with 1,4-dimethyl-7-isopropyl-bicyclo-decapentane (BD.I). Tuberculous lesions were markedly less and tuberculin reactions exceedingly milder when compared with the normal and immunized untreated animals. The diminished state of hypersensitivity does not lower the immunity but even permits the immune principle to work to a better advantage. Desensitization with BD.I is not followed by toxic manifestations. It was previously reported that BD.I acts exclusively on the host, stimulating the cellular defense mechanism to an increased activity. The state of hypersensitivity, camouflaging the immune principle, can be considered as a defect in the RES function. If the RES is stimulated to an increased activity, by appropriate treatment, the defense apparatus is able to prevent completely or partially the development of unnecessary or harmful inflammatory responses to the tuberculin administration. Desensitization is thought to be a consequence of the RES stimulation and therapeutic effect of BD.I in experimental tuberculosis can be attributed to this mechanism.

Slide Culture of Tubercle Bacilli: Further Diagnostic and Comparative Trials.

D. M. SIMPSON, *Department of Veterans' Affairs, Camp Hill Hospital, Halifax, and R. W. REED, McGill University, Montreal.*

In 1955 Simpson and Reed (1) published details of a diagnostic slide culture method and compared results of culture of 2248 sputum specimens by this method and a conventional technique. Additional results are presented for a total of 5265 specimens, further demonstrating the decided advantages of the slide culture technique. 92% of positive-smear specimens yielded positive cultures, as against 71.8% by routine methods. Results were

almost identical with both methods in the smear negative group, the influencing factor apparently being the great disparity in size of inoculum. Speed of recovery of organisms was pronounced in the slide culture method, 100% being positive by the end of 14 days, whereas controls approached this figure only at the end of eight weeks.

Results are also presented of a comparison of slide culture with four standard egg media, a blood agar medium and guinea pig inoculation. Slide culture results were superior to the five solid media collectively, and to guinea pig inoculation. In the smear-positive category 91.5% of slide cultures were positive, as against 73.9% collectively for solid media and 74.0% for guinea pig inoculation. Some of the possible reasons for guinea pig failure are discussed and, in instances where the slide culture alone is positive, evidence is advanced to support the likelihood that the cultures represent virulent and not saprophytic strains.

Reference: 1. Simpson, D. M., and Reed, R. W.: Slide Culture of Tubercle bacilli: 111 Routine Diagnostic Trials. *Canad. J. Microbiol.*, 1955, 1: 495-501.

Complement Fixing Antibodies in Tuberculous Guinea Pigs.

E. KILLOUGH, N. A. LABZOFFSKY, W. J. A. PERCY and J. W. BELL, *Division of Laboratories, Ontario Department of Health, Toronto.*

GUINEA pigs were infected with tuberculosis by injection of known inocula of tubercle bacilli. Blood was drawn at weekly intervals, and the sera tested for complement-fixing antibody. The results indicate that complement-fixing antibody appears regularly at about the end of the second week after infection, reaching a maximum titre during the fifth or sixth week and then remaining stationary or declining according to the physical condition of the animal.

Hydatid Disease in the Yukon and Northwest Territories.

J. B. POOLE, *Parasitologist, Laboratory of Hygiene, Dept. of National Health and Welfare, and Research Associate, McGill University*, and R. WOLFGANG, *Assistant Professor of Parasitology, McGill University, Macdonald College.*

HYDATID disease caused by the larval stage of tapeworms of the genus *Echinococcus*, has not in the past been considered of great importance in North America. Of the relatively small number of human cases recorded, the vast majority are considered to have acquired the infection outside this country. However, the Institute of Parasitology of McGill University, in cooperation with the Laboratory of Hygiene and the Indian Health Services of the Department of National Health and Welfare, has conducted, during the past two years, an intradermal skin testing program of the native population of Northwestern Canada. A total of 1,863 Indians have been tested with 27% giving positive reactions. In addition data have been obtained of the incidence of hydatid cysts in wild herbivores and the adult worms in wild carnivores. The presence of sylvatic *Echinococcus* in this area is definitely established. The mode of infection to man and the importance of the relationship between sylvatic hydatid and that in Indians is considered. The estimated rate of hydatid infection in humans in the Northwest Territories is compared to that in other endemic countries of the world. The relative importance of the apparent widespread distribution of this disease in Northwestern Canada, in relation to the rest of the country, is examined in regards to its public health significance.

A Simple Laboratory Method for the Determination of Protein-Bound Sugar.*

J. STERNBERG and R. NADEAU, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal and Hospital-Sanatorium St. Joseph, Rosemount, Montreal.*

A SIMPLIFIED method for the determination of protein-bound sugar has been devised by using the reducing properties of the tetrazolium salts. Among the various tetrazolium compounds, the Neo-Tetrazolium phosphate appeared to give a specific reaction with the protein-bound sugars in human serum. A 0.25% solution of the above compound in NaOH N/10 gives a deep blue colour, with a maximum of absorption at 635 m μ .

*Work aided by a Federal-Provincial Health Research Grant-in-aid.

0.2 ml. serum is precipitated with 1 ml. WO_4Na_2 10% and SO_4H_2 N/3; the precipitate is centrifuged, then redissolved in 9 ml. NaOH N/2. The reducing agent (1 ml. Neo tetrazolium solution) is then added, and the developed colour is read at $635\text{ m}\mu$ after 70 minutes. The results are converted into values expressed as mg. of bovine fraction IV-I, taken as standard. This fraction is considered the richest in protein-bound carbohydrates.

The results seem to indicate that there is not a parallelism between the protein-bound carbohydrates as determined by this method and by the other procedures, such as anthrone or the paper electrophoretic determination (basic fuchsin-periodic acid); this has been noted especially in serum from tubercular patients. However, it seems that the above test might be of clinical importance in the differential diagnosis of certain liver diseases (cirrhosis, obstruction icterus).

Two Unusual *Trichophyton Rubrum* Infections.

F. BLANK, *Department of Bacteriology and Immunology, McGill University, Montreal.*

TRICHOPHYTON RUBRUM was isolated from a scaly, eczematous lesion on the leg of a woman who also had a mycotic infection of the hands and the finger nails. Hyphae were not only found in the epidermis but in the cutis as well as revealed by a biopsy taken from the lesion of the leg. There was no inflammatory and granulomatous reaction of the tissues invaded.

Hairs removed from the beard of a man with pustular folliculitis presented three different, unusual eudo-ectothrix parasitic patterns. They were found to be the initial and transitory parasitic growth-phases of *T. rubrum*. The final endothrix picture was not found among the hairs removed.

Correlation of Various Antibiotic in Vitro Sensitivity Tests.

ARNOLD BRANCH, *Antibiotic Control Laboratory, Lancaster Hospital, Lancaster, New Brunswick.*

This paper presents an up to date account of the work of the antibiotic control laboratory on the control of in vitro sensitivity tests in Department of Veterans' Affairs Hospital Laboratories. The results of correlating the agar well, dry disc and tube dilution tests are given, as well as the percentage of discrepancies still occurring among participating laboratories. The penicillin bacteriostatic test continues to be the most difficult to control. In addition to the three methods previously mentioned, two others have been studied. These are the agar pour plate and the single disc method where the size of the zone of inhibition is measured to indicate the degree of sensitivity. A comparison of the latter two tests has been made with the former three.

Emphasis has been placed on outlining a zone of non-clinical response (resistance) in the sensitivity test; organisms in this group are seldom eradicated by therapy. The end results of therapy in 100 cases are charted against the in vitro sensitivity of the organism. Objection is taken to the use of a single disc of low concentration unless it is clearly understood that this outlines sensitivity and not resistance. Since the disc method appears to be the choice where large numbers of tests are ordered, more experiments have been performed to compare the reaction of discs from various manufacturers and to compute the maximum amount of a particular antibiotic that will diffuse in unit time.

A New Method for Rapid Quantitative Evaluation of Results of Filter Paper Electrophoresis of Serum Proteins.

M. D. POULIK, *Department of Hygiene and Preventive Medicine, University of Toronto.*

The filter paper strip with separated and stained components of human serum or any other stainable material is scanned and a typical distribution curve appears on a cathode ray tube. This curve is electronically corrected to true extinction values and areas under each corresponding distribution curve electronically integrated. Any part of the curve (up to 2 mm. in width) can be taken for computation. The percent distribution of the components is read directly on a linear scale. It takes 2-3 minutes to evaluate one paper strip.

Antibody Response to Streptococcal Infections Determined by Complement Fixation.

ANNE L. GILLEN and HARRY A. FELDMAN, *Department of Medicine, State University of New York, Upstate Medical Center at Syracuse, New York, and the Kilian Research Laboratory, Wieting-Johnson Hospital for Rheumatic Diseases.*

THREE antigenic fractions were prepared from broth cultures of types 12 and 3 streptococci. One antigen was prepared by precipitating the broth with sodium hexametaphosphate as described by Jacobs and Gillis for Diphtheria toxoid. This antigen reacted with the Sera of 2 pairs of rabbits which had received types 3 and 12 vaccines. By cross absorption of these sera, type specific complement-fixation reactions were demonstrated. Thirteen of 17 human sera obtained 2-3 weeks after streptococcal infections had increases of 4-32-fold with the phosphate antigen. These titers could be increased about 8-fold with cold fixation overnight as compared with one hour at 37° C.

Group specific antigens were prepared by formamide extraction and by Lancefield's method followed by removal of the type specific antigen. These antigens reacted with the same rabbit antisera following fixation overnight at 5° C. The reaction was not demonstrable with 1 hour fixation at 37° C. Using the formamide antigen, increases in titer were demonstrable in 2 of 10 human sera 2-3 weeks after infection.

The type specific 3 and 12 antigens were removed from the Lancefield extracts by formation of their picrates. These antigens reacted with the rabbit antisera but no increases were observed in 8 pairs of human sera obtained from individuals infected with these types or with 6 pairs obtained from individuals infected with other types.

The Comparative Properties of 263 Cultures of Mannitol-Positive Micrococci Isolated from Food and from Clinical Sites.

T. S. THATCHER and W. SIMON, *Food and Drug Directorate, Department of National Health and Welfare, Ottawa.*

MANNITOL-POSITIVE micrococci isolated from cheese or butter and from clinical sites, including enteritis of post-antibiotic-therapy development, have been examined in relation to their comparative properties of the "Bergey" determinative criteria, the production of the coagulase and phosphatase enzymes, of α - and β -hemolysins, enterotoxin (cat reaction), antibiotic-resistance and phage-grouping. The majority of isolates from food were members of phage group IV, type 42D; most clinical isolates were phage group III. A coagulase reaction was more dependable than any other criterion considered as an indication of enterotoxigenicity but was not absolute since filtrates from isolates that were not typable by standard phages and which were coagulase-negative were able to induce emesis in cats. β -lysin was commonly produced by enterotoxin-producing strains. α -lysin showed little relationship to enterotoxigenicity. Lysogenesis and enterotoxigenicity seemed to be unaltered by the property of antibiotic-resistance.

Bacteriophage Types of Staphylococci in New Brunswick.

HELEN J. BROWN, P. M. TRACEY and R. A. H. MACKEEN, *Provincial Laboratories, New Brunswick Department of Health and Social Services, Saint John, N.B.* DURING the period from December, 1954, to October, 1955, 616 strains of coagulase-positive *M. pyogenes* var. *aureus* have been typed with the basic international set of 20 bacteriophages and tested for antibiotic sensitivity. The organisms were isolated from clinical material received at the laboratories of the New Brunswick Department of Health and Social Services and from noses and throats of hospital personnel in several New Brunswick centres.

The 464 clinical strains typed included 11.0% in Group I, 14.0% in Group II, 56.9% in Group III, 4.7% classified as Miscellaneous and 13.4% which could not be typed at the Routine Test Dilution.

In New Brunswick, more infections appear to be caused by Group I and II strains and fewer by Group III organisms than elsewhere. Type 81 was encountered more frequently than any other single strain (46% of the Group III isolations) and was responsible for several outbreaks of hospital infection.

It was found that 60% of the Group II strains were penicillin-resistant, a much higher proportion than hitherto reported. Otherwise the antibiotic sensitivity patterns of staphylococci in New Brunswick differed little from those in other parts of Canada and the United States.

The 152 strains isolated from healthy hospital personnel followed a distribution pattern very similar to that of the clinical strains. They were classified as follows: Group I, 17.2%; Group II, 13.2%; Group III, 48.0%; Group IV, 0.7%; Miscellaneous, 7.8%, and Untypable, 13.2%.

Investigations in a large general hospital disclosed a staphylococcus carrier rate of 50-66%. Many of the strains isolated were similar to those occurring in sporadic post-operative and other hospital infections, indicating the potential hazard which may exist.

Influence D'Une Infection Chronique sur le Developpement de la Poliomyelite Chez le Hamster.

V. PAVILANIS, A. BOUDREAULT et P. LEMONDE, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal.*

It was shown that hamsters inoculated with BCG, living or killed, presented a chronic infection. To find how this infection with BCG would influence poliomyelitis in hamsters we did the following experiments.

The hamsters were inoculated intraperitoneally with 5 mg. of BCG, alive or killed, and one month later were infected intracerebrally with MEF-1 virus. The animals were followed during 30 days.

The animals inoculated with MEF-1 virus diluted 1/10 one month after living BCG inoculation presented a mortality of 75% (65/87) and those inoculated with killed BCG and one month later with MEF-1 virus showed a mortality of 65% (66/104). Among control animals inoculated with MEF-1 virus we observed a mortality of 54% (55/102). The maximum mortality induced by living or heat-killed BCG alone is only 6% during one month.

If we reduce the concentration of the virus and inoculate the MEF-1 strain diluted to 1/100 the differences between groups are even greater. In the virus control group, we observed a mortality of 38% (51/132). In the group treated with living BCG one month before virus inoculation, the mortality was 64% (79/124) and in the group inoculated with killed BCG, it was 74% (40/54).

These experiments show that BCG, killed or alive, enhances experimental poliomyelitis in hamsters. This effect is greater in young than in old animals.

Poliomyelitis Vaccination Study—Department of Health of Ontario.

Preliminary Report presented by G. K. MARTIN.

DURING the spring months of 1955, 309,875 Ontario elementary school children in Grades I, II and III received two doses of poliomyelitis vaccine produced by the Connaught Medical Research Laboratories.

A controlled study designed to assess the effect of this vaccine on the incidence of poliomyelitis is being carried out in Ontario with investigation of all cases of paralytic and non-paralytic poliomyelitis occurring in elementary school children aged 5 to 12 years. The data being collected include clinical information and laboratory reports of tissue culture examination of stool specimens submitted from each study case.

The Laboratory Background of the Ontario Poliomyelitis Vaccination Study 1955.

A. J. RHODES, *Hospital for Sick Children, Toronto*, N. A. LABZOFFSKY, M. E. PANTIDOU and A. J. BEALE, *Division of Laboratories, Ontario Department of Health.*

In association with the epidemiological enquiry of the Department of Health for Ontario into "poliomyelitis" in public school children aged 5-12, two virus laboratories in Toronto have collaborated in the examination of stools from cases by the inoculation of monkey kidney monolayer cultures. The results are summarized in the Table.

It will be seen that there was very little laboratory-confirmed poliomyelitis in Ontario in 1955. In the vaccinated group there was only one laboratory-confirmed case, and in the unvaccinated group there were 5 such cases. There were 6 patients whose stools yielded an unidentified agent in the vaccinated group, and 8 such patients in the unvaccinated group. The stools of 18 patients in the vaccinated and 13 in the unvaccinated groups were negative for viruses. There is thus a trend in favour of the value of vaccine in reducing poliomyelitis, but the figures are too small to justify any firm conclusion at the present time.

Cases of "poliomyelitis"*	Total	Viruses isolated from stools		
		Poliomyelitis	Unidentified**	Negative
<i>Paralytic</i>	10	2	1	7
Vaccinated	5	0	1	4
Unvaccinated	5	2	0	3
<i>Non-Paralytic</i>	41	4	13	24
Vaccinated	20	1	5	14
Unvaccinated	21	3	8	10
Grand Total	51	6	14	31

*Diagnoses are provisional and mostly made on admission; they will be subject to review when full clinical and laboratory findings are available.

**Many of these are suspected to be Coxsackie viruses; further studies are in progress.

It is clear that many of the cases of reported "poliomyelitis" were not in fact caused by the virus of poliomyelitis; their stools yielded an unidentified virus or were negative for viruses. Studies are continuing to elucidate the aetiology in these cases.

Acute and convalescent serum was obtained from several of the children and the results of poliomyelitis neutralizing antibody determinations will be presented.

The Estimation of Poliomyelitis Neutralizing Antibodies in Serum.

C. W. J. ARMSTRONG, *Connaught Medical Research Laboratories, University of Toronto.*

THE technique used, a modification of the tissue culture colorimetric method of Salk et al., *Am. J. Hyg.*, 54, 60:214, for the laboratory evaluation of the National Foundation for Infantile Paralysis 1954 field trial, is described. This procedure has continued to give satisfactory results. Recent innovations are discussed and representative human data presented.

Studies on the Avian Pleuropneumonia-like Organisms.

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CONTINUED studies on the etiology of chronic respiratory disease (CRD) of chickens and turkeys have revealed that both a virus and a pleuropneumonia-like organism (PPLO) are involved. The PPLO have been shown to produce the chronic symptoms observed in this disease. Infection of chickens with the PPLO alone produces a mild and transient coryza and infection of turkeys results in a sinusitis.

Since it was found that the PPLO could agglutinate avian red blood cells, it was possible to develop a hemagglutination-inhibition test. A survey of Canadian flocks utilizing this test revealed that approximately 45% were positive. The investigations concerning the nature of infection with the PPLO are outlined.

A Case of Anthrax in Man Contracted from the Bovine in Ontario.

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THE paper reports a case of cutaneous anthrax in man contracted at necropsy of a cow that died from the disease. The necropsy findings in the cow were somewhat atypical. As anthrax is rare in Ontario, the case history and a brief review of the disease are presented. The possibility of a delay in diagnosis of this infection is emphasized.

